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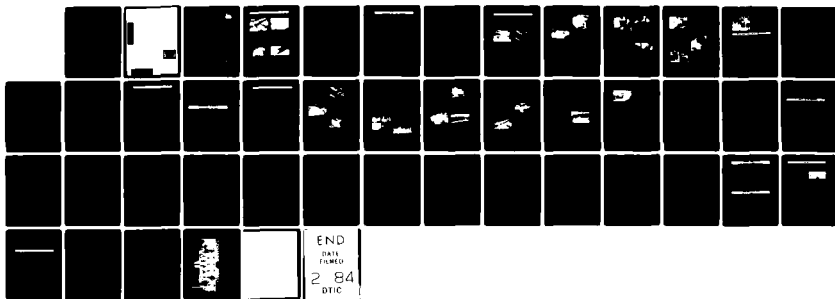
FY83 POSTURE REPORT: RESEARCH DEVELOPMENT ENGINEERING  
AND ACQUISITION(U) ARMY BELVOIR RESEARCH AND  
DEVELOPMENT CENTER FORT BELVOIR VA 1983

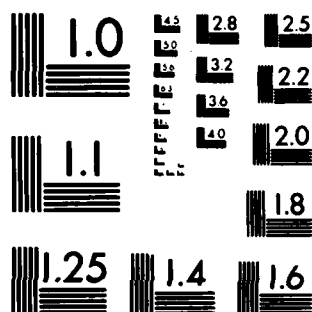
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## FOREWORD



Fiscal year 1983 has been a year of success for the Belvoir Research and Development Center. The Center plays a vital role in developing combat and battlefield support equipment for current and future Army requirements. A significant management effort was devoted to establishing a systematic and active interface with the user community and Readiness Commands to facilitate the development of new concepts and the improvement of materiel now in the inventory. The success of these efforts is demonstrated by the Center's performance this year. We have type classified eight items this year which include such diverse equipment types as the Utility Landing Craft and Logistics Support Vessel; 7½-Ton Crane and 6000-Pound Rough Terrain Forklift Truck; 3- and 10-Kilowatt Electric Power Generators; Expandable Van for the Topographic Support System (TSS); and the Multipurpose Firetruck. First-Time-Buy quantity procurements, totaling \$137.4 million, were accomplished for six items, and eight items were transitioned to the Readiness Commands. Efforts toward future systems include assault bridging, remote minefield detection and neutralization, petroleum supply and distribution, tactical deception, sensors/robotics/artificial intelligence, and automated logistic support.

The Belvoir R&D Center has also concentrated on improved program management in order to manage broad, wide-ranging mission and program areas. In March 1983, a major reorganization went into effect that streamlined the Center to perform its mission with greater efficiency. This reorganization resulted in the rearrangement of the Center's interfaces to coincide with Army proponents through the redistribution of program mission areas. Seven technical laboratories have been merged into five; responsibility for resource management—manpower and money—has been unified into a single directorate; the logistics and acquisition management functions have been combined and strengthened; and two senior level management groups were formed to provide comprehensive program management, one from a technical and the other from a readiness perspective.

This report provides details on the many managerial and technical achievements accomplished throughout the year and the continued support to the Army across a diverse repertoire of research and development capabilities.

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## BELVOIR R&D CENTER PROGRAM AREAS

### MOBILITY/COUNTERMOBILITY



Countermine, counterobstacle, bridging, construction, and barrier equipment and techniques are being developed to enhance mobility for our forces and deny it to the enemy. In FY83, Belvoir R&D Center furnished equipment for tests on an integrated countermine system for the M1 tank, provided engineering support for procurement of airborne/airmobile construction equipment for rapid deployment forces, and awarded contracts for design and fabrication of light and heavy assault bridges.

### ENERGY



Energy projects support virtually every major system. They include development and specification of fuels and lubricants for DOD land mobility and ground support equipment, electric power sources for missile support and general purpose requirements, and heaters and air conditioners for vehicles and shelters containing buttoned-up crews and/or highly sensitive electronic equipment. In FY83, a \$19.3 million contract was awarded for the procurement of the 10-kW, 28-V Aviation Support Generator.

### SURVIVABILITY



Survivability fields of endeavor include counter-surveillance and tactical deception, physical security, tunnel detection, sensors/robotics/artificial intelligence, field fortifications, and topographic equipment. Major actions during the fiscal year included award of a \$67.2 million contract for 222 additional models of the Position and Azimuth Determining System (PADS). PADS is a rapid, all-weather field artillery locating system which provides continuous update data accurate to less than 10 meters.

### LOGISTICS



Belvoir R&D Center activities in logistics extend from off-shore containerships and tankers to forward area water and refueling operations. Projects encompass the fields of water supply, fuels handling, materials handling, supply distribution, marine craft, and support equipment. Thirteen items were transitioned to TROSCOM in FY83, including a tactical water distribution system for rapid deployment forces and a 30-ton air-cushion vehicle which provides a new dimension in logistics-over-the-shore (LOTS) operations.

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# ORGANIZATION AND MISSION

## INTRODUCTION

This FY83 Posture Report is the Center's report on the funds allocated to perform its mission, how these funds were utilized, and what was achieved. The report describes the mission program areas, the multiplicity of the tasks, management and technical activities to support the program areas, fiscal and manpower status, and noteworthy accomplishments during the year. The contents are divided into five basic sections. The Organization and Mission section highlights the Center's mission, personnel, and fiscal resources and the most significant technical accomplishments and noteworthy management actions. The Management Achievements section presents the program structure, planning, and management accomplishments. The Technical Achievements section details the technical effort to accomplish the Belvoir R&D Center research, development, and acquisition mission. The final two sections emphasize Belvoir R&D Center's unique facilities/capabilities and summarize the Center's activity indicators.

This Posture Report, combined with previous reports, serves as the Center's corporate memory providing information on scope of activities, resources, and technical and managerial accomplishments.

## MISSION AND FUNCTIONS

Belvoir R&D Center, located 15 miles south of the Nation's Capital at Fort Belvoir, Virginia, conducts one of the Army's most widely diversified programs in the development of combat support and battlefield support materiel designed to enhance the mobility and survivability of friendly forces and to deny mobility to the enemy. The Center also serves as the Army's lead laboratory for countermine and camouflage technologies. The Center has a total authorized workforce of 1189 civilians and 51 military personnel. The 240-acre headquarters and main laboratory complex is supplemented by an 820-acre test area also located on Fort Belvoir and the US Army Fuels and Lubricants Research Laboratory (AFLRL), a Government-owned/contractor-operated facility in San Antonio, Texas.

The Center's research, development, engineering, and initial production buys are geared to satisfy approved Army requirements to provide the United States with a superior combat and deterrent force in the major program areas of mobility/countermobility, survivability, energy, and logistics. The principal thrust of these program areas is the fielding of combat support and combat service support equipment, but additional development falling within the Center's many areas of expertise is performed for other commands, project managers, DOD organizations, and government agencies. The following are Belvoir R&D Center's FY83 principal fields of endeavor within the four major program areas:

## FIELDS OF ENDEAVOR

<b>MOBILITY/COUNTERMOBILITY</b>	<b>SURVIVABILITY</b>
<ul style="list-style-type: none"><li>● Bridging</li><li>● Countermine</li><li>● Construction Equipment</li><li>● Barriers</li><li>● Field Fortifications</li></ul>	<ul style="list-style-type: none"><li>● Materials Technology</li><li>● Countersurveillance and Tactical Deception</li><li>● Physical Security</li><li>● Tunnel Detection</li><li>● Topographic Equipment</li><li>● Sensors/Robotics/Artificial Intelligence</li></ul>
<b>ENERGY</b>	<b>LOGISTICS</b>
<ul style="list-style-type: none"><li>● Electric Power</li><li>● Fuels &amp; Lubricants</li><li>● Heaters &amp; Air Conditioners</li></ul>	<ul style="list-style-type: none"><li>● Water Supply</li><li>● Fuels Handling</li><li>● Supply Distribution</li><li>● Marine Craft</li><li>● Support Equipment</li><li>● Materials-Handling Equipment</li></ul>

The wide range of advanced technology resident in Belvoir R&D Center's scientific and engineering workforce attracts substantial reimbursable funding for research, development, and engineering projects from many other government organizations. Included in a long list of "customers" are the Project Managers for the Army's main battle tank (M1 Abrams), PATRIOT Air Defense Missile, and FIREFINDER Artillery Locating System, as well as several DARCOM Centers (TROSCOM, TACOM, MICOM, AMMRC, and ARRADCOM), the Defense Nuclear Agency, the Department of Energy, and the Marine Corps.

In addition to research, development, engineering, and acquisition, the fielding of materiel for the Army hinges on several other factors. Some of these include:

- |  |  |
|--|--|
| <ul style="list-style-type: none"><li>• Threat</li><li>• Operational Concepts</li><li>• Doctrine</li></ul> | <ul style="list-style-type: none"><li>• Army Organizational Structure</li><li>• Training</li><li>• Management of Resources</li></ul> |
|--|--|

As a result, Belvoir R&D Center has established direct working relationships with a variety of other agencies. Foremost among these are Headquarters TRADOC and several proponent TRADOC schools representing the user community, logistics support agencies, and readiness commands. Additionally, Belvoir R&D Center uses the services of more than 130 contractors to accomplish its mission.



## ORGANIZATIONAL RESPONSIBILITIES

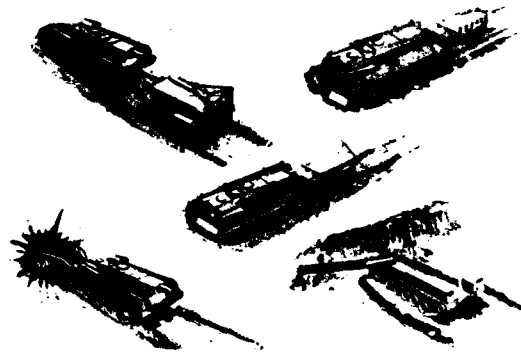
The Belvoir R&D Center organization consists of five laboratories, six directorates, and a variety of technical and administrative offices. These organizational elements are geared to improved management of RD&A programs and resources and to provide the integrated logistics support needed for effective deployment of Belvoir R&D Center equipment. Four of the five laboratories are in alignment with TRADOC schools that develop requirements for combined arms, engineer, engineer service, and logistics support. The fifth provides technical support to Armywide users of fuels, lubricants, and various materials employed in Belvoir R&D Center developments. Responsibilities and/or activities of the laboratories and other major elements are defined in this section.

### COMBINED ARMS SUPPORT LABORATORY



The Combined Arms Support (CAS) Laboratory has been designated as the developer of all DOD interior physical security equipment as well as exterior perimeter lights and barriers. This joint service responsibility is designed to thwart theft, vandalism, and sabotage and is focused on the protection of nuclear and chemical storage sites as well as other sensitive installations. Other major mission areas of the Laboratory include tunnel detection and sensors/robotics/artificial intelligence. As DARCOM's lead laboratory for camouflage technology and tactical deception, the CAS Laboratory is responsible for countering and deceiving threat detection and target acquisition systems across the electromagnetic spectrum, including ultraviolet, visual, near and thermal infrared, radar, and certain laser wavelengths. Currently, major emphasis is on increasing the survivability of Army units and systems through a new tactical deception program. The CAS Laboratory is responsible for the program management and system integration efforts as well as the development responsibilities for the multispectral aspects of the program. In the topographic area, the CAS Laboratory has the mission of production engineering, technical support to procurement, and field support for topographic, surveying, mapping, and materiel testing equipment.

### ENGINEER SUPPORT LABORATORY



The Engineer Support Laboratory supports the combat engineer function. It is responsible for the mobility/counter-mobility program areas, which include counter-mine/counter-obstacle, bridging, construction equipment, and barriers/obstacles and field fortifications. The Laboratory is DARCOM's lead laboratory for counter-mine technology. It strives to advance the technology base to develop and field equipment for mine detection and neutralization. In addition, a program for the development of a test-bed counter-obstacle vehicle (shown in artist's concept) to overcome manmade barriers is underway. The Laboratory also devises techniques for effective deployment of its systems and provides materials and technical consultation for the Army's training effort. The counter-mine program is responding to the needs of today's Army by emphasizing technology for neutralization and remote detection of minefields. Tactical bridging and associated systems are developed to provide the means to cross both wet and dry gaps. Priorities are the development of both light and heavy assault bridges for dry gaps and light assault rafts for wet gaps. Work is also underway on bridge access/egress systems and the use of new composite materials in bridge structures. Construction equipment to meet the Army's diverse requirements is normally acquired off-the-shelf.

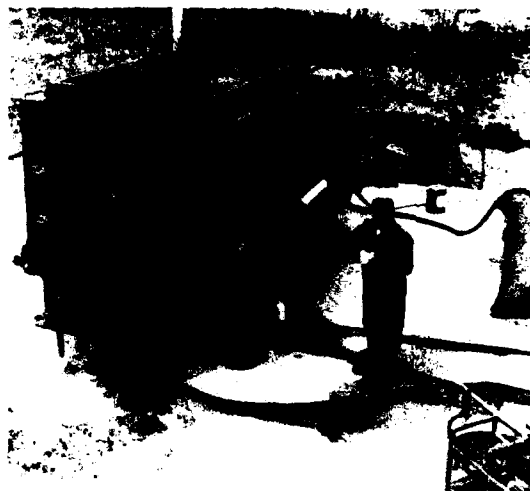
or adapted from commercially available items. Principle acquisition thrusts are in airborne/airmobile tactical earthmoving equipment, commercial construction equipment, and a small emplacement excavator. The barriers and obstacles effort is focusing on synthesis of current or easily achievable obstacle components into an advanced integrated system. Field fortifications are developed to provide protection from enemy weapons fire for individual soldiers, crew-served weapons, and command posts.

### ENGINEER SERVICE SUPPORT LABORATORY



The Engineer Service Support Laboratory is responsible for research, development, and engineering support for the Army's mobile electric power sources, heaters, air conditioners, general-purpose lighting, and power distribution systems. Electric power sources and environmental control systems are essential to nearly all weapons, communications, and support systems in the modern Army. The Laboratory provides engineering support for the acquisition and improvement of the Army's standard families of these items and conducts research and development programs for new items to meet Army requirements. Included are fuel cell power units and Stirling engine-driven generators for silent power needs; signature-suppressed diesel-engine-driven generators, solid-state power conditioner units, energy-efficient air conditioners, compact gas-turbine-driven generators, multifuel space heaters, and solar cell power systems.

### LOGISTICS SUPPORT LABORATORY



Finding the answers to questions concerning supply distribution, mobility equipment technology, energy, materials handling, water and wastewater management, and combat support technologies is the mission of the Logistics Support Laboratory. This Laboratory is responsible for these fields of endeavor, which can be broken down to those which are currently in focus: handling, distribution, and storage of water and bulk petroleum, oil, and lubricants (POL); water purification equipment; equipment and techniques for pollution abatement; firefighting and fire suppression equipment; amphibians and water craft; container discharge facilities; communication-navigation electronics; wastewater systems; materials-handling equipment and systems; rail equipment; and diving, gas generating, and container support. An important part of the Laboratory's responsibility lies in its continuous support to the critical water support and supply equipment needs of the US Army Central Command (formerly the Rapid Deployment Joint Task Force). Through efforts in the development, engineering, testing, evaluation, procurement, and technical support of these technologies, the Laboratory assists in the Center's mission of providing technical guidance and support to the overall Army community.

## **MATERIALS, FUELS, AND LUBRICANTS LABORATORY**



The Materials, Fuels, and Lubricants Laboratory supports Belvoir R&D Center's total program through basic and supporting development, testing, evaluation, and engineering in the fields of fuels, lubricants, functional fluids, corrosion preventives, chemistry, chemical coatings, organics, plastics, ceramics, metallurgy, composite materials, rubber, adhesives, coated fabrics, radiation, packaging, and transportability. The Laboratory is the Center's representative for all transportability matters related to material development and manages the Materials Testing Technology (MTT) program. The Laboratory also develops and evaluates materials to conform to Federal, Environmental Protection Agency (EPA), and Occupational Safety and Health Act (OSHA) regulations; has lead responsibility within the Army and the DOD for RDTE of Ground Mobility Fuels and Lubricants and Chemical Coatings; serves as United States Army Principal Delegate to North Atlantic Treaty Organization (NATO) Military Agency for Army Standardization Army Fuels and Lubricants Working Party and Air Standardization Coordinating Committee's Working Party 15 on Fuels, Lubricants, and Allied Products; provides DARCOM health physics support in testing and evaluating radiation problems; serves as the Office of Primary Responsibility for packaging of hazardous materials; is a primary DARCOM laboratory for the Materiel Deterioration and Control (MADPAC) program; and offers technical assistance and consultation services to the military and civilian community.

## **RESOURCE MANAGEMENT DIRECTORATE**



The mission of the Resource Management Directorate is to provide effective and efficient resource management for the Center and tenant activities. The Directorate serves as principal staff advisor on all matters pertaining to financial and manpower management. Financial management functional areas include program budgeting, cost and economic analysis, internal review and audit compliance, management review and analysis, productivity measurement and improvement, accounting and financial reporting. Manpower management functional areas serve to provide staff management and control of Belvoir R&D Center's force structure through the utilization and allocation of manpower resources and the management of organization mission and functional assignments.

## **PROCUREMENT AND PRODUCTION DIRECTORATE**



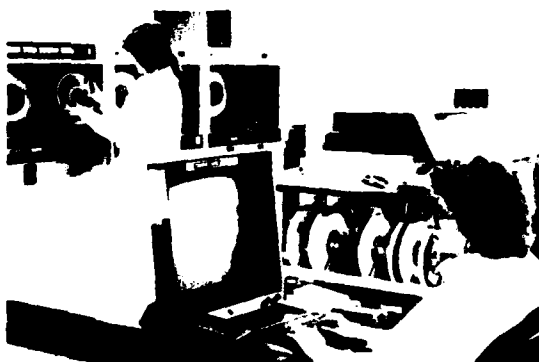
The mission of the Procurement and Production Directorate is to set procurement policy for the Center to procure supplies and services applicable to the research and development and initial production missions of Belvoir R&D Center. In addition, the Directorate provided procurement support to tenant activities such as Night Vision and Electro-Optics Laboratory, Facilities Engineering Support Agency, Engineer Topographic Laboratory, Computer Systems Command, and Defense Systems Management College. In FY83, the Directorate executed 9130 individual procurement actions aggregating about \$309.6 million. Of this, the tenant activities awards amounted to \$52.0 million. Also included were Small and Disadvantaged Business awards totaling about \$21.5 million.

## **READINESS AND INTEGRATED LOGISTICS SUPPORT DIRECTORATE**



The mission of the Readiness and Integrated Logistics Support Directorate is to achieve fielded, supportable, and cost-effective mission performance of Army systems and equipment through policy, guidance, and execution of the Belvoir R&D Center integrated logistics support (ILS), engineering/acquisition, and standardization programs in support of the laboratories. The Directorate serves as the major staff interface with Readiness Commands. In addition, overall management responsibility is provided for program transitioning, technical data package requirements planning, procurement plan processing, configuration management, data management, and Department of Defense Standardization Program. This Directorate also manages and operates a complete engineering data entry storage, retrieval micro-reproduction, and distribution system.

## **MANAGEMENT INFORMATION SYSTEMS DIRECTORATE**



The Management Information Systems Directorate supports Belvoir R&D Center and DARCOM scientists, engineers, and administrators in the areas of command information systems, project management, analysis, programming, computer simulations and models, specialized experimental design and analysis, software

development, and workplace automation. The computer center has continued to upgrade services by providing increased capacity and faster access disk file storage, a higher line-speed communication front end, and a high-speed swap device for interactive jobs. Facilities now include Control Data 170-730, PRIME 750, and PLEXUS P25 Computer Systems; a color graphics terminal with paper and transparency printer; a mini-micro computer laboratory; a complete library of mathematical, statistical, graphics, scientific, engineering, and data base management software, upgraded terminals, word processors, and multifunction workstations. The Center's Information ADP System supports a number of data bases which contain merit pay, project management, work order, and standardization data. Information from these structures is readily retrievable via the newly developed Information Resource Management Procedure Directory System.

## **PRODUCT ASSURANCE AND TESTING DIRECTORATE**



The Product Assurance and Testing Directorate manages and executes a comprehensive program of evaluation and testing of Belvoir R&D Center's equipment during the research, development, preproduction, and production phases. The Quality and Reliability Division monitors the Center's first-time-buys to determine the acceptability of materiel for fielding and implements Belvoir R&D Center's Test Policy and Independent Assessment functions. The Test and Evaluation Division and the Environmental and Field Division are dedicated to testing materiel used in a variety of facilities under different environmental conditions. These include actual field testing of mobile equipment or testing equipment under simulated conditions through the use of hi-lo temperature and altitude chambers, shock and vibration machines, rain test fixture, and others.

## SUPPORT AND FACILITIES DIRECTORATE



The Support and Facilities Directorate provides assistance to the Center and customers in support of their missions by furnishing library, administrative, supply, and property services. Control, management, and maintenance of installation equipment is provided by the Belvoir R&D Center Equipment Manager. A mission accountable office serves Belvoir R&D Center and tenant activities and provides consolidated property book accountability. The Directorate provides complete support for processing travel requests, official mail, publications, blank forms, telecommunications, and passport services. Shop facilities are available for the fabrication and modification of items ranging from precision instruments to mobile bridges. Audio-visual facilities provide the still photography, graphic arts, motion pictures, video tapes, photo instrumentation, and technical reports required to support RD&E programs.

## PERSONNEL AND FISCAL RESOURCES

### PERSONNEL RESOURCES

*Fiscal year 1983 was a year of change for Belvoir R&D Center in the area of Manpower Resources. The Center ended FY82 with a manpower authorization of 71 military and 1200 civilians; these figures were reduced to 60 military and 1187 civilians on 1 October 1982 by the reassignment of the Test, Measurement, and Diagnostic Equipment (TMDE) element consisting of 11 enlisted and 15 civilian personnel to a new centralized TMDE Headquarters at Redstone Arsenal, Huntsville, Alabama. This element, although reassigned for control and accountability purposes, remained physically at Belvoir R&D Center to support the Center. During the year these resources were further reduced by 2 RDT&E Manpower cuts; the first for 6 spaces in Program-Wide Activities (AMS Code 665801) and the second for 3 spaces in Mobility Equipment Technology (AMS Code 612733). These reductions in manpower authorizations brought the Center's Civilian Employment Projection (CEP) to 1178 by the end of FY83.*

The actual assigned civilian strength for FY83 began at a low of 1167 on 1 October 1982, due to a decremented end-strength assigned by Headquarters, DARCOM for end FY82. Through the use of RESHAPE initiatives to utilize overhires and temporaries, as well as an intensive recruitment program, this figure grew rapidly and peaked at 1361 in June 1982 due to the influx of the Summer Hire Program. Assigned strength for the year averaged 55 military and 1250 civilians, excluding the Summer Hire Program. The Center ended FY83 with an assigned strength of 51 military and 1189 civilians.

A decremented target end-strength for end FY83 of 1174 was received from Headquarters DARCOM in May 1983. This figure was increased to 1178 in July and finally to 1188 in September, thus eliminating the necessity and expense of terminating temporary employees with appointments which ran through the end of FY83. Through close end-strength management, CIVPERSINS verification, and close coordination with the servicing Fort Belvoir Civilian Personnel Office, Belvoir R&D Center, once again, met its assigned target end-strength.

During FY83, Belvoir R&D Center completed a major reorganization concept plan and submitted it to Headquarters DARCOM for review and approval. The new organizational structure was designed and staffed completely within the Center's allocated manpower resources, combining many previous organizational elements such as functions and areas of endeavor. Seven Laboratories were combined into five and nine support elements into seven. Approval and implementation were planned for early FY84.

Early in FY83, US Army Corps of Engineers announced its intention to establish a centralized support facility for Corps of Engineers activities in the area. This included the Facilities Engineering Support Agency (FESA) and the Engineer Topographic Laboratory (ETL) which were being supported in the areas of procurement, accounting, travel, and supply by Belvoir R&D Center. Follow-

ing a survey of support functions furnished FESA/ETL by Belvoir R&D Center, and verification by Headquarters US Army Corps of Engineers and Headquarters DARCOM, 14 spaces were earmarked for transfer to the US Army Corps of Engineers with the support functions. However, later developments reduced this number to 12, with the two Security Guard spaces to remain with Belvoir R&D Center until the completion of the physical move of FESA in its entirety from the Belvoir R&D Center compound. The 12-space transfer was to become effective in FY84. At approximately the same time, ERADCOM announced its intention to establish a procurement support element for the Night Vision and Electro-Optics Laboratory (NV&EOL), which had been supplied by Belvoir R&D Center. After considerable study, 18 spaces in support of the NV&EOL procurement function were earmarked for transfer to ERADCOM at the end of FY83.

#### Profile of Workforce

A.		TOTAL WORKFORCE						
		Required	Authorized	Actual				
Civilians		1414	1178	1189				
Military		67	60	51				
Aggregate Total		1481	1238	1240				
B.		ON-BOARD STRENGTH						
Civilian:	ES			3				
	Permanent GS			1064				
	Temporary GS			29				
	Part-Time GS			4 Perms				
	WAE			0				
	Permanent WG			76				
	Temporary WG			13				
	Total Civilian			1189				
Military:	Officers			19				
	Warrant Officers			1				
	Enlisted			31				
	Total Military			51				
Special Programs:	Cooperative Office Ed			0				
	Summer Employment Youth			0				
	DA Interns			34				
C.		PERSONNEL DATA						
	Auth	On-Board	Doctors	Masters	Bachelors	Other	Tech	Av Grade
Military	60	51	1	8	7	—	12	—
Civilian	1178	1185	34	110	364	29	102	9.527
Total	1238	1236	35	118	371	29	114	9.527

## FISCAL RESOURCES

The total budget from which Belvoir R&D Center financed its operation in FY83 was \$467 million. Of this, \$366.8 million was FY83 funds and \$100.2 million was carryover funds from prior years. This budget represents a 3-percent increase over the FY82 budget. As in FY82, the largest portion of the FY83 budget (65 percent) came from procurement funds. Approximately \$220.8 million was in support of first-time-buy programs.

RDTE funds totaled \$147.5 million, with \$10.5 million being carryover. Reimbursable funding increased by \$21.5 million, while support to Project Managers increased from \$17.3 million to \$34.2 million.

A significant change in direct funding was realized in the programs for Mobility/Counter-mobility Systems, Logistics Systems, and the Survivability Systems with increases of approximately \$2.9 million, \$0.6 million, and \$3.5 million, respectively. The program for Energy Systems realized a decrease of approximately \$2.1 million. This was due primarily to a change in procedures in FY83 in which 6.3b and 6.4 funds are furnished direct to the Project Manager. Mobile Electric Power. Overall, the direct RDTE program increased by approximately 12 percent.

The accompanying table illustrates the ratio of outside/inside obligations for FY83. Fiscal obligation targets of authorized funds established by DARCOM were 95.5 percent for RDTE, 100 percent for OMA, and \$165.4 million for OPA. Through intensive top level management, the RDTE and OMA targets were met or exceeded. OPA obligations totaled \$149.2 million, as the award on an \$11.5 million contract is delayed due to a protest and negotiations on other contracts resulted in lower per-unit costs, therefore achieving the following savings:

CONTRACT	SAVINGS
Topographic Support System	\$6.4 million
Position Azimuth Determining System	5.6
50,000-lb Rough-Terrain Forklift Truck	2.5
Lighter Air-Cushion Vehicle, 30-Ton	5.0
10-Kilowatt Generator	3.0

### FY83 FUNDING FROM ALL SOURCES INCLUDING CUSTOMERS (AS OF 30 SEP) (\$ in thousands)

DARCOM HQ RDTE FUNDS	FY83 SUBTOTAL	FY83+1 SUBTOTAL
6.1 RESEARCH	2,003	1,865
6.2 EXPLORATORY DEVELOPMENT	13,222	11,006
6.3 ADVANCED DEVELOPMENT 6.3A	8,901	13,327
6.3B	9,917	10,423
6.4 ENGINEERING DEVELOPMENT	12,785	24,733
6.5 MANAGEMENT AND SUPPORT	10,493	7,790
TOTAL MISSION	57,321	69,144
OTHER RDTE		
DARCOM OTHER	74,307	70,892
NON-DARCOM	3,326	3,700
NON-ARMY	12,531	10,550
RDTE TOTAL	147,485	154,286
PROCUREMENT FUNDS		
DARCOM HQ	220,762	117,844
OTHER	14,343	12,212
NON-DARCOM (OTHER ARMY)		
NON-ARMY	67,419	66,446
OPA TOTAL	302,524	196,502
OMA FUNDS		
DARCOM HQ	16,121	13,990
OTHER	822	850
OMA TOTAL	16,943	14,840

**OUTSIDE/INSIDE OBLIGATIONS**  
(as of 30 SEP)

EFFORT	Industry and Academia Contract Total** Obligations			Other DARCOM Labs Contract Total** Obligations		Other Government Agencies Contract Total** Obligations		Estimated Cost to Administer*	
	in \$000	in \$000	%	in \$000	%	in \$000	%	in \$000	%
<b>RDTE Funds</b>									
6.1	1983	1010	51			65	3	40	2
6.2	12968	5798	45	972	7	342	3	389	3
6.3a	8909	5567	62	1394	16			267	3
b	10181	4976	49	895	9	300	3	305	3
6.4	12724	4917	39	401	3	2717	21	254	2
6.5	10426	2857	27			177	2	104	1
6.7									
<b>MISSION TOTAL</b>	57191	25125	44	3662	6	3601	6	1359	2
<b>DARCOM OTHER</b>	46961	26014	55	525	1	1068	2	1409	3
<b>NON-DARCOM (Other Army)</b>	2891	2213	80					867	3
<b>NON-ARMY</b>	8049	4653	58	2		745	9	241	3
<b>RDTE TOTAL</b>	115092	58035	50	4189	4	5414	5	3876	3
<b>PROCUREMENT FUNDS</b>									
<b>DARCOM</b>	149175	137424	92	11751	8			5967	4
<b>NON-DARCOM (Other Army)</b>	12131	12131	100						
<b>NON-ARMY</b>	21973	21973	100						
<b>OPA TOTAL</b>	183279	171528	94	11751	6			5967	3
<b>OMA FUNDS</b>									
<b>DARCOM</b>	16032	3063	19	1924	12	53		641	4
<b>NON-DARCOM (Other Army)</b>	822	335	41					33	4
<b>NON-ARMY</b>									
<b>OMA TOTAL</b>	16854	3398	20	1924	11			674	4
<b>GRAND TOTAL</b>	315225	232961	74	17864	6	5467	2	10517	3

\*In-House cost for purely administrative duties, both technical and managerial. Since these costs are to run, not use, the contract, do not include costs for parallel work, coupling with related work, testing or exploiting.

\*\*Total obligations for each line; i.e., 6.1, 6.2, etc.



## NOTEWORTHY TECHNICAL CONTRIBUTIONS

**Improving Fuel Stability.** A military specification has been developed by Belvoir R&D Center for a Stabilizer Additive for Diesel Fuel which is intended for use in situations where diesel fuel or equipment is subject to storage or infrequent use. Typical applications are to be prepositioned diesel fuel or equipment in depot storage and to National Guard and Army Reserve vehicles which are inactive during a large part of the year. Other possible applications could be to fuel supplies for designated high-priority missions or to improve marginally stable fuel scheduled for consumption during extremely hot weather conditions.

A diesel fuel quality assessment program was initiated to determine the quality of the fuel actually in use at various Army installations. A total of 69 diesel fuel samples from 20 installations were analyzed under this program. A similar program, code-named RIVET MILE, was completed in cooperation with the Strategic Air Command, US Air Force. Under RIVET MILE, 121 diesel fuel samples from missile sites were analyzed and recommendations were made for maintaining the quality of the fuel. Field liaison assistance was also provided to several installations. Assistance was provided to units experiencing filter plugging at Fort Polk, Fort Carson, and the Montana Army National Guard. In each case, diesel fuel and filter samples were analyzed and recommendations were made to correct the problem. In two other cases, assistance was provided to the Defense Fuels Supply Center and Radford Army Depot to reclaim off-specification diesel fuel. In both cases, laboratory tests showed that treatment with the stabilizer additive was sufficient to bring the fuel back within specification limits. When the recommended treatment was completed, approximately one million gallons of diesel fuel were returned to the inventory for issue.

**Composite Material Structural Components.** The properties of advanced materials have been exploited to develop lightweight structural members. This work, which was initially directed at mass and bulk reduction of mobile military bridge structures, has produced common structural components which have many types of application. The high cost per pound of the raw materials used in the composite formulation has been, in part, traded off against the use of low labor intensive methods of fabrication and configuration generation. The techniques utilized have been adapted from the textile industry where automation, low labor cost, and high quality control have been prime considerations in the production of high-quality, low-cost textile products.

Several bridge components have been produced this year. A tensile link element designed to replace an all-aluminum link has been produced by the continuous wet winding of graphite fiber over and around stainless steel spools to produce an element which has no internal joints and which is 40 percent lighter in weight than the element it replaces. This element has passed all static load tests and has greatly exceeded the fatigue life requirements of the member. A second element made feasible by the wet winding process is the continuously wound multihollow shear web panel. Honeycomb shear panels with graphite/epoxy face materials are not new, but their fabrication by a low labor horizontal winding process demonstrates the economies available to produce high quality panels utilizing a combination of the winding and molding technique. The technique produces rectangular panels 1 meter by 7 meters in a four-panel per winding sequence. Panels of any thickness and other dimensions are easily accommodated. The technique is modified to build in hard points at any location on the panel. Structural modification to strength and stiffness is possible by programming wind speeds and angles. Our most ambitious effort in the production of structural members is the wet weaving of a buckling critical tubular element—the common structural column. The machine technique being employed here is the multispool braiding head. The special feature of this process is that it provides the capability of precision emplacement of fibrous materials of different moduli of elasticity. Simply stated, we can longitudinally place stiff fibers while, at the same time, radially placing strong fibers to the best advantage of both. The tubular element thus produced has a high stiffness-to-weight ratio and can be produced in any length and any wall thickness. The problem of end fittings is eliminated by simply braiding in metallic threaded collars. This effort will be demonstrated and tested early next year.

**Volatile Organic Compounds (VOC).** Many new technologies have been developed in the area of low-solvent-content coatings for compliance to Federal regulations on volatile organic solvent emissions, toxic waste, and workplace safety regarding toxic exposure to lead, chromates, and other heavy metals. Excellent results have been obtained in replacing lead and chromates in anticorrosive primers, and all Army camouflage coatings are being converted to a lead- and chromate-free pigment without the use of toxic substances. Several high-solids polyurethane coatings have been evaluated that will comply with decontamination tests. All of these conform to the emission limit max-

imum of 3.5 lb/gal of VOC. A high-solids alkyd coating has also been evaluated that conforms to the performance properties of one of the widely procured camouflage coatings. Waterborne epoxy anticorrosive primers have been formulated that conform to the present solvent-base epoxy primers for steel and aluminum substrates. A high-solids polyester also has been developed that can be used in specific applications to replace the standard ammunition coatings.

A significant amount of work is still being performed on chemical agent resistant coatings, in addition to that being done under the environmental program on waterborne and high-solids coatings. Work has been completed on inorganic and organic pigments that are not affected by decontaminants. Testing has been completed on single-component polyurethane resin that is VOC compliant and chemical agent resistant. A specification is being written for the product.

## NOTEWORTHY TECHNICAL MANAGEMENT ACTIONS

**Transition of LACV-30.** In 1982, Belvoir R&D Center initiated a proposal to transition the management of the LACV-30 program to the Readiness Command. Although both commands recognized that formal transition would normally occur only when contracts were completed closed out, there were compelling reasons to consider means to accomplish the management hand-off as soon as possible. Complexities included the directed buy of a second company of 12 air-cushion vehicles, involving both FY82 and FY83 funds. Early management meetings established the philosophy that allowed transition of the management functions of the LACV-30 program to be considered separately from the contracts themselves. Within this context, both commands drew up lists of actions which might be vulnerable to slippage during the proposed transition process. These actions were analyzed carefully and each item was designated to the appropriate command for follow-up responsibility. In this way, completion of actions already in process were assured of management continuity following transition. Transition action officers were appointed by each command and were charged with attainment of comments and approvals from all the key staff elements and directorates of both commands as a pre-condition to proposing its approval by the commanding officers. All pertinent issues were resolved which resulted in the management transition on 14 February 1983. Completion of this action greatly simplified the acceptance of the responsibility for making the second company procurement by TSARCOM and centralized the management control within the Project Office, Army Watercraft. The close-out of the first company procurement will be accomplished by Belvoir R&D Center in early FY84.

In relation to the OSHA program on compliance to the lead and chromate exposure regulations, all of the camouflage coatings have been reformulated to include lead- and chromate-free types. Three new anticorrosive primers that are both lead- and chromate-free have been developed. Two of these are of an alkyd resin type, and the third is an epoxy type that can be used with the chemical agent resistant polyurethane topcoat.

In the area of lead- and chromate-free primers, research efforts have shown that an organic zinc complex pigment in solvent-base coatings will provide corrosion resistance equal to or better than the present lead- and chromate-base primers. Coatings formulated with this material can be applied over bare cold-rolled steel and provide adequate protection. This material is also being added to the ammunition coatings to improve performance.

**Tactical Deception.** In FY83, the tactical deception program included planning and hardware support to develop a tactical deception capability for the 9th ID. Planning included generation of a comprehensive plan, technical work in defining signatures and system equipment, and generation of quick-reaction proposals (QRPs) for follow-on deception devices. Hardware support included delivery of first-generation devices such as three types of vehicle decoys, flash-sound simulators and radar reflectors and contracting for second-generation devices. The QRPs developed will lead to later production of multispectral and communications-electronic deception devices. The approved plan calls for overall program management and multispectral work by Belvoir R&D Center and electronic device development, consuming approximately half the total funding, by other DARCOM commands.

**Mine Clearing Roller.** The Mine-Clearing Roller neutralizes single-impulse, pressure-activated mines in the track path of the pusher tank. The system can withstand and survive at least two detonations of mines containing up to 22 lb of high explosive. A dog-bone-and-chain assembly clears tilt-rod-actuated mines between the roller banks. A quick-disconnect feature is provided which allows the tank driver to disconnect the roller from inside the tank within 30 seconds. During this FY, the Mine-Clearing Roller was conditionally released to Europe and Korea for evaluation. Field testing in both theaters was successful. An IPR is scheduled in FY84 to address type classification.

## MANAGEMENT ACHIEVEMENTS

Belvoir Research and Development Center has grown in total capability to manage and accomplish its total mission with excellence. Establishment of priorities within Belvoir R&D Center for R&D projects, detailed analysis and critical review of technology base programs, utilization of life-cycle management techniques, successful first-time-buy programs, and maintenance of relationships to assure transition to Readiness Commands are areas wherein resources and efforts have been concentrated.

### BELVOIR R&D CENTER INTERNAL REORGANIZATION

After almost a year of planning, Belvoir R&D Center's internal reorganization was approved at HQ, DARCOM on 19 September 1983. From March 1983, Belvoir R&D Center had been operating provisionally under the new system. DARCOM's blessing of the new organization now permits many of the beneficial changes to be permanently affected commandwide. The primary objectives of the reorganization, in addition to the desire to strengthen more effective and efficient performance, was the rationalization of the Center's interface to coincide with Army proponents. The new structure also allows every organizational element—both line and staff—to have more ready access to the command group. This has been accomplished by streamlining the Center so that each element is no more than one step removed from the command group. These concepts, in addition to the other new changes, will allow a more effective and efficient performance of our mission-related goals and objectives.

Other noticeable changes which have occurred have been the merger of seven technical laboratories into five, unification of resources management responsibility—manpower and finance—into a single directorate, strengthening of logistics and acquisition management functions, and the formulation of two new senior level management groups: the Office of the Associate Technical Director and the Office of the Principal Director for Readiness. The merger of the laboratories from 5 to 7 has created 5 commodity laboratories which are closely aligned to our 4 mission areas: Mobility/Counter mobility (Engineer

Support Laboratory), Survivability (Combined Arms Support Laboratory), Logistics (Logistics Support Laboratory), and Energy (Engineer Service Support Laboratory and Materials, Fuels, and Lubricants Laboratory). Not only will this allow a more equal distribution of technical personnel among the laboratories, but it also aligns the laboratories to a principal Army proponent for each of our four major fields of endeavor.

The senior level management groups were formed to provide comprehensive program management, and they carry the responsibility for total Center purview—one from a technical and the other from a readiness perspective. These offices, directed by SES appointees, were chartered to provide direction to new program starts, to control current endeavors, and to develop and maintain interface with outside agencies, particularly those related to logistics, production, and fielding.

The Office of Associate Technical Director is responsible for formulating and executing the Center's RDTE program, managing the planning and execution of the Center's technical programs, coordinating laboratory activities, and providing user interface. The main focus of the Office of the Principal Director for Readiness, the staff counterpart, is on the orchestration of staff support to the line organizations, with particular concentration on acquisition planning, logistics support, and transition and fielding activities. This office is the proponent for interface with the Readiness Commands and FORSCOM.

## DEVELOPMENT PROGRAM

During FY83, one of the Center's primary objectives was the intensive management of the command-designated top-priority developmental, nondevelopmental, and first-time-buy items. The top-priority items were selected by the command group based primarily on the yearly DARCOM reviews, TRADOC and DCSOPS priorities, and other contributing factors.

### TOP-PRIORITY ITEMS

#### COUNTERMINE AND COUNTEROBSTACLE



**Surface-Launched Unit Fuel-Air Explosive (SLUFAE) Mine Neutralization Systems.** During late 1982 the DARCOM Commander, at the request of TRADOC, funded the completion of SLUFAE RDTE tasks and released project funds to complete the rocket motor facility at Longhorn Army Ammunition Plant, Marshall, Texas. These actions will enable the SLUFAE system to be produced in minimum time for mobilization readiness. All three facility projects and development efforts will be completed during 1984. Two of the development tasks, the ruggedized training rocket and the new five-unit XM626 shipping/storage container have resulted in substantial projected cost savings both in acquisition and logistic costs.



**Counterobstacle Vehicle (COV).** The COV is a Belvoir R&D Center effort to provide combat engineer units the capability to overcome obstacles, such as antitank ditches, berms, log cribs, abatis, and minefields, and to clear a path through rubble built-up areas. The program started relatively low-keyed in FY81 but took on high visibility in FY82 with a Memorandum of Understanding between the United States and Israel, signed in September 1981, to cooperate on the research and development of the COV. The COV incorporates the M88 Tank Recovery Vehicle Chassis with an improved engine to provide increased draw-bar pull and a power takeoff. The vehicle will feature telescopic digging arms and a combination full-width mine plow dozer blade for countermine and obstacle removal operations. BMY Corporation of York, Pennsylvania, is the prime contractor and is fabricating the test bed vehicle.



**Airborne Minefield Detection System (AMIDS).** Remote detection of minefields has been recognized as an important objective since 1953, with major research

effort expended until 1963. Because of the Southeast Asia conflict, the program received little interest and was not revived until 1977. Warsaw Pact forces have developed tactics, doctrine, and equipment that emphasize the use of flank protective minefields during offensive operations. Remote detection of minefields is now recognized as one of the highest priority requirements for US Forces. The AMIDS program has been implemented to meet this requirement. The AMIDS consists of two principal components: (1) The Alternate Mission Payload (AMP) which will be compatible with the existing Army remotely piloted vehicles (RPV) and allows acquisition of the imagery required to identify minefields from a distance; and (2) the Forward Deployed Ground Station (FDGS) which will receive imagery from the AMP, process the data, and provide either a direct-image display to the operator or a cued display that analyzes the imagery for the operator. Efforts for AMIDS this fiscal year have been toward development of a miniaturized high-resolution scan, RPV Compatible Sensor Package and development of a computer algorithm that extracts minefield features from imagery. During preliminary data collection efforts with existing sensors, there has been sufficient success in identifying patterned minefields under some environmental and operational scenarios, and the critical technical barriers have been identified for a concentrated R&D effort.



**Mine-Clearing Line Charge (MICLIC).** The US Marine Corps conducted a quick-response program intended to use existing assets whenever possible to develop an explosive line charge system. The approach was to provide a mobile platform that could be towed by wheeled or tracked vehicles. The USMC system consists of the M58A2 high-explosive linear demolition charge, the Mark 22 rocket for projecting the charge across the minefield, the rocket launcher, and the M353 trailer chassis. The assembled system is towed by a light-forces combat vehicle to perform the minefield breach. The

system is towed to the minefield and the rocket is launched over the towing vehicle by the operator. The rocket pulls the line charge out of the container across the minefield. Once the charge is lying on the minefield, the operator detonates it. Cost and Operational Effectiveness Analysis (COEA) performed by the USA Engineer School (USAES) in 2QFY82 concluded that the USMC M58 Line Charge System was more cost-effective than the Army's M173 Line Charge System. Belvoir R&D Center is planning for the NDI acquisition of the USMC M58 Line Charge System. The USMC and Belvoir R&D Center are currently coordinating closely and in several instances jointly as the development progresses toward acceptance by both Services.

### WATER SUPPLY

**3000-gal/h Reverse Osmosis Water Purification Unit (ROWPU).** In implementation of an established required operational capability (ROC) and in accordance with DA and DARCOM directives, two competing, performance-type contracts will be awarded in 2Q84 to develop a 3000-gal/h ROWPU. Three prototype units will be designed, fabricated, and tested under each contract. The units will be subjected to an accelerated acquisition program, with type classification projected for 1QFY86. The resulting type-classified unit will be capable of producing potable water from raw fresh water, sea water, brackish water, and water contaminated with nuclear, biological, and chemical (NBC) agents and will be capable of operating in ambient air temperatures of -25° F to 110° F. The unit will be transportable on a 30-foot flatbed semitrailer pulled by a 5-ton tractor. It will be capable of being air lifted by C-130, C-141, or C-5 aircraft and transported on a seagoing military vessel.

### CONSTRUCTION EQUIPMENT



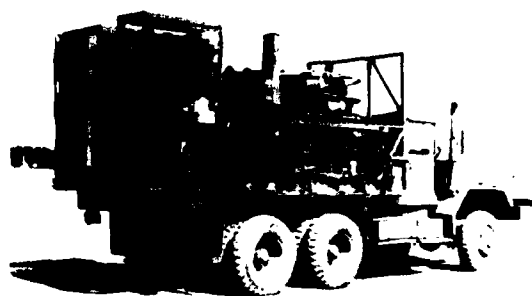
**Small Emplacement Excavator (SEE).** The Army has identified a requirement for a small lightweight excavator with tactical mobility comparable to supported wheeled units. This tractor will be utilized to provide defilade or covered positions to improve the survivability of weapons systems, combat support systems, and the individual fighting soldier. The high mobility of the Small

Emplacement Excavator (SEE) will provide the US Army Forces with an earthmoving machine capable of rapid movement between battle positions. Present mechanical excavation equipment is limited to crawler tractors, scoop loaders, and backhoe/loaders. All three machines have extremely low mobility and, therefore, must be transported by available truck/trailers for high-speed travel. The SEE will be transportable in current military aircraft and will be capable of airdrop and low-altitude parachute extraction (LAPES) as well as externally transportable by medium-lift helicopter. It will be capable of highway speeds and have tactical mobility similar to supported tactical wheeled vehicles. The tractor will be equipped with a front-mounted bucket and rear-mounted backhoe. A front-mounted dozer blade can also be attached in the front with a quick-hitch assembly. Auxilliary hydraulic tools such as pavement breakers, rock drills, and augers are also being provided. Initial procurement is programmed in FY84 with a 5-year multiyear program planned. The SEE tractor will replace the current backhoe/excavator in the light- and heavy-combat divisions.

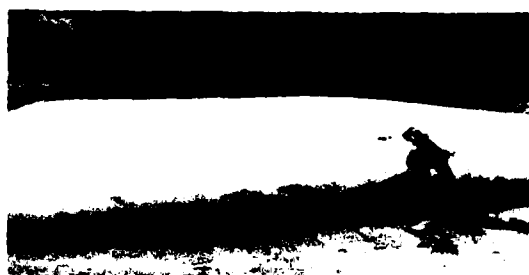
#### PETROLEUM DISTRIBUTION



**Pipeline Outfit, Petroleum (POP).** The POP consists of three major components: the pipeline set composed of 5 miles of pipe and all ancillary items; the pipeline maintenance set, comprised of all necessary tools and equipment to make pipeline repairs; and the tactical pipeline construction equipment. The construction equipment includes a commercial hydraulic pipe-joining press which was obtained by Belvoir R&D Center. The press produces a 6-inch or 8-inch pipe joint, either aluminum or steel, with the integrity of a welded pipeline. A Special In-Process Review (SIPR) was conducted at Belvoir R&D Center on 14 July 1982 and a Non-Developmental Item (NDI) acquisition strategy was approved. Testing of the Pipe-Joining Press was completed; a SIPR is scheduled for 1Q84 for the Type Classification (TC) decision.



**Petroleum Hose System (PHS).** The PHS consists of a trailer-mounted 600-gal/min operating pump operating at 150 lb/in.<sup>2</sup>, 11,000 ft of 6-in. hose, a hose deployment-and-recovery device, and ancillary items. It is envisioned that the PHS will provide a through-put capacity of twice the capacity of the existing 4-in. hose outfit it replaces. The PHS will also have an improved method of recovering the hose for rapid deployment. DTI Testing of a prototype model was conducted at Aberdeen Proving Ground (APG), Maryland, during June-September 1982. OTI testing was conducted at Fort Pickett, Virginia, during October-November 1982. A Validation In-Process Review is scheduled for March 1984.



**Bulk Fuel Tank Assembly (BFTA).** The BFTA is a large-capacity, self-supporting bulk petroleum storage tank which can be rapidly deployed with little or no ground preparation. The tank assembly will be used with high-capacity commercial tankers and will function with all standard military fuel storage and handling equipment. The BFTA can also be utilized on the pipeline systems as intermediate tank farms, regulating stations, or head terminals. The capacity of the BFTA is 5,000 barrels (210,000 gallons); it can be air transportable by CH47 or CH54 helicopter. The tank assembly is needed to support contingency operations in undeveloped theaters. It will be made from single-ply elastomeric-coated fabric. The DTI testing of the BFTA was completed in 2QFY83. A DEVA-IPR for the type classification decision is scheduled for FY84.

## ELECTRIC POWER

**1.5-kW Methanol Fuel Cell Power Units.** This electric power generator is being developed for use in brigade and forward tactical unit where extremely quiet operation is required for non-detectability. The fuel cell approach was selected to meet the needs of the Army's approved requirement for a family of silent, lightweight electrical energy plants (SLEEP) because it provides virtually silent operation. The program continued in the Engineering Development phase during FY83 with Prototype Qualification Testing by the contractor (PQT-C) initiated during January 1983. Testing revealed technical deficiencies in the design of the fuel conditioner subsystem and the program was modified to allow redesign of the fuel conditioner subsystem. In addition, two power units are to be altered moderately to allow them to undergo an abbreviated PQT-C. The purpose of the abbreviated PQT-C was to develop sufficient test data to make a determination as to whether or not other serious deficiencies exist. The program contract calls for 14 units to be delivered for the DT and OT II phases of the development and acquisition cycle. At present, it is forecast that DEVA IPR will be held 2QFY86 with initial operational capability (IOC) occurring 1QFY90.

## BRIDGING



**Light Assault Bridge (LAB).** This program was initiated in FY82 to provide rapidly deployable, air-transportable assault bridging capability for the Light Infantry Division. Seven different concepts were evaluated and scale models were made of the most promising concepts. This work was analyzed by Belvoir R&D Center and the US Army Engineer School, and a double-fold scissors bridge was selected as the concept to enter full-scale development. The Light Assault Bridge is transported on a special-purpose trailer that can be towed by a vehicle with a 15,000-pound pintle capacity (M9 ACE, 5-ton truck, etc.). The trailer with bridge has

roll-on/roll-off capability on the C141 aircraft, permitting rapid air transportability. The bridge is launched hydraulically in 5 minutes by a mechanism mounted on the trailer. The operator remains inside the towing vehicle during launching. When in place, the bridge will support Military Load Classification (MLC) 30 loads over gaps up to 23 meters wide. In addition to completing the concept evaluations, other significant events on the LAB program this year were approval of the ROC, completion of the validation IPR, and award of the development contract. Type classification is programmed for June 1986 with initial operational capability planned for December 1988.

DOUBLE FOLD SCISSORS LAUNCH (37W)



**The Heavy Assault Bridge (HAB).** The HAB will provide improved assault bridging capability for heavy armored forces. The HAB will have increased load capacity and span and greater mobility than do existing assault bridges. The HAB will be mounted on the M-1 tank chassis to provide mobility compatible with the M-1 tank forces it will support. Made of lightweight aluminum alloys and composite materials, the bridge will be light enough and strong enough to permit spans up to 29 meters while supporting Military Load Classification 70 loads. The bridge can be launched in 5 minutes by the operator inside the chassis using the hydraulic launch mechanism mounted on the front of the chassis. During FY82, a study was conducted to evaluate five different concepts for the HAB. Scale models of these concepts were built to assist in the evaluation process. Belvoir R&D Center and the US Army Engineer School, after analyzing the results of the study, decided that two of the concepts should be evaluated further in advanced development. Prototypes are being built of a double-fold scissors bridge and a flip-cantilever bridge. Entry into full-scale development is visualized in FY87.

## PRIORITY FIRST-TIME-BUY PROGRAM

### WATER SUPPORT EQUIPMENT

**Water Equipment for CENTCOM.** The urgent acquisition of water supply equipment to supply the Central Command, formerly the Rapid Deployment Joint Task Force (RDJTF), continued as one of the Army's highest priority requirements during FY83. Initial operational testing and training was completed successfully on water supply equipment at the National Training Center (NTC), Fort Irwin, California. Some changes were incorporated into some of the equipment as a result of this testing. Delivery of water supply equipment to the depot for operational project stocks continues.

**Tactical Water Distribution System (TWDS).** All TWDs were completed under the first production contract for 14 TWDs. First article testing was completed on the second production contract for 21 TWDs and a third production contract was awarded for 14 TWDs. The TWD was transitioned to TROSCOM.

**Small Mobile Chiller.** First article testing was completed for the first production contract of small mobile water chillers and all 100 units were accepted. A second contract for 716 chillers was awarded. The chiller was transitioned to TROSCOM.

**150,000-Gallon/Day Reverse Osmosis Water Purification Unit.** Delivery of 150,000-gal/d Reverse Osmosis Water Purification Units continues. Two of these purification units were provided to drought stricken Kwajalein Island to produce drinking water from sea water.

### MARINE CRAFT

**Lighter Air-Cushion Vehicle, 30-Ton (LACV-30).** The LACV-30 has the primary mission of transporting two 20-foot MILVANS. It can also transport wheeled and tracked vehicles, engineer equipment, pallets, and other cargo. Riding on a cushion of air, the LACV-30 can operate on water, marginal land areas, beaches, ice, and snow to deliver containerized cargo to the beach while the beach site is prepared for landing craft.

The first 12 LACV-30s are being formed into the 331st Transportation Medium Lighter Company, stationed at Fort Story, Virginia. The 331st performs lighter over-the-shore missions and combat service support operations

and will support secondary missions in coastal, harbor, and inland waterways; search and rescue; and medical emergency missions.

The first production craft was flown 23 April 1981. It was tested extensively at Wheatfield, New York; Aberdeen Proving Ground; and Fort Story prior to acceptance. By the end of September 1983, 10 production craft were accepted by the Army with the remaining 2 to be delivered in the first quarter FY84. A Follow-On Evaluation (FOE) was conducted in July and August 1983 to evaluate the adequacy of supportability and organization.

A contract to procure 12 additional craft was awarded in September 1982. This contract was definitized in July 1983 and was transferred to TROSCOM in August 1984. The second LACV-30 company is scheduled to be activated in August 1983. The LACV-30 program management responsibility transitioned from the Belvoir R&D Center to the Project Office for Amphibians and Watercraft on 14 February 1983.



**Ribbon Bridge Erection Boat (RBEB).** During FY83, Belvoir R&D Center continued to provide engineering support to the first-time-buy procurement of 250 RBEB from the sole source United Kingdom contractor (Fairley Allday Marine). Efforts to evaluate potential product improvements in operation and maintenance of the RBEB and cradle system were completed. A modification kit contract was awarded for ancillary items which will be added by a contractor to all of the boats and cradles which were fielded. Tests on a Belvoir R&D Center design hybrid cooling system and a proprietary Fairley Allday Marine system were accomplished and a decision on which system is to be incorporated in future boat contracts and possible retrofit on fielded boats is pending. These hybrid systems with a closed cooling loop will allow for maintenance to be performed on engines while in operation out of water.



## BRIDGING



**Link Reinforcement Set (LRS).** In February 1982, the Link Reinforcement Set (LRS) for the Medium Girder Bridge (MGB) was adopted as a non-development item to meet the requirement to extend the MGB Military Load Class (MLC) 60 capability for the spans in excess of 100 to 160 feet. The LRS is a proprietary item designed by a UK commercial firm to whom the UK Government has granted worldwide marketing rights. Belvoir R&D Center initiated a joint services (US Army and Marine Corps) acquisition of the system and a contract was awarded in February 1983. Testing of the system was conducted at Aberdeen Proving Ground and at the UK Government test facility at Christchurch, UK. Belvoir R&D Center is coordinating this total testing effort. The Army plans to release the LRS for production after completion of the MLC 60 tests.

## TOPOGRAPHIC SUPPORT

**Topographic Support System (TSS).** The TSS is a combat support system which will provide the field commander with complete topographic support in the response time commensurate with tactical requirements. It consists of seven subsystems. Each subsystem is comprised of one or more sections, each dedicated to a specific phase of the TSS operation. All but one section, the Direct-Support Section, is housed in a 30-foot by 8-foot container mounted on a semitrailer chassis. The Direct-Support Section is housed in a 20-foot by 8-foot by 8-foot container mounted on a truck for increased mobility. When all sections are completed, there will be 289 sections for a cost of approximately \$100 million. The FY79 procurement was designated a Small Business Minority (BA) set aside. The Belvoir R&D Center contract was awarded 18 July 1979 to the American Development Corporation (ADCOR), Charleston, South Carolina. The FY81 procurements have been accomplished and the FY82 and FY83 procurements have been options to the basic contract with ADCOR, except

for the Press and Camera Sections, which are being produced by Tooele Army Depot, Tooele, Utah. Productions of the FY79 and FY81 quantities are completed and the FY82 and FY83 production is underway.

## ELECTRIC POWER

**10-kW, 28-V d.c. Generator Set.** During the maintenance of Army aircraft, the requirement exists for ground support equipment to supply various types of power simultaneously. The Army is currently using a 7.5-kW, 28-V gasoline-engine-driven generator set consisting of 5 models employing 2 types of engines and 5 types of generators. These sets are no longer procurable and will not be logistically supportable past 1983. As a replacement for these sets, the first programmed year of a 4-year contract was awarded in June 1983 to procure 135 10-kW, 28-V d.c. turbine-engine-driven, wheel-mounted generator sets. This 10-kW set is a lightweight, self-propelled, compact ground power unit/system capable of providing hydraulic, pneumatic, and a.c./d.c. electrical power separately or simultaneously. The generator set will be used in support of aviation maintenance, ground check-out, and starting of Army aircraft. A total of 794 sets will be procured during the four programmed years. Initial delivery is scheduled to begin in 1986.

## OTHER ITEMS

The Belvoir R&D Center Development Program consists of the 6.3B (Systems Advanced Development) and 6.4 (Engineering Development) program elements distributed by funding categories as follows:

Funding Category	FY83 (thousands)	Percent of Total RDTE Program
6.3B	9219	20.6
6.4	12210	27.2
Total	21429	47.8*

\*Total RDT&E Program (6.1 - 6.4) = 44.838 (including FY82 carryover)

Efforts in Advanced Development and in Engineering Development are supported by 22 individual projects allocated to the 4 technical areas as follows:

PROGRAM AREA	Development Program (thousands)			Percent of Total
	6.3B	6.4	Total	
Mobility/Countermobility Systems	2767	4744	7511	35.1
Energy Systems	0	50	50	0.2
Survivability Systems	4206	6316	10522	49.1
Logistics Systems	2246	1100	3346	15.6
TOTAL	9219	12210	21429	100.0

#### 6.4 (ENGINEERING DEVELOPMENT)

##### Mobility Systems

Cleared-Lane Marking System  
M60 Tank Track Width Mine-Clearing Plow  
Detecting Set, Mine, Vehicle-Mounted, AN/VRS-5  
Surface-Launched Unit, Fuel Air Explosive  
Light Assault Bridge  
Military Amphibious Reconnaissance System

##### Logistics System

3000-gal/h Reverse Osmosis Water Purification Unit

##### Energy System

250,000-Btuh Self-Powered Multi-Fuel Army Space  
Heater

##### Survivability System

Facilities Intrusion Detection System, Advanced Group I  
and II

#### 6.3B (SYSTEMS ADVANCED DEVELOPMENT)

##### Mobility/Countermobility Systems

Vehicle Magnetic Signature Duplicator  
Tactical Bridge Access/Egress for Current Bridging  
Heavy Assault Bridge

##### Logistics Systems

Prestaged Ammunition Loading System  
POL Distribution System/Bulk Fuel Tank Assembly  
POL Distribution System/Petroleum Hoseline System  
POL Distribution System/Arctic Fuels Dispensing Eqpt  
POL Distribution System/Pipeline Outfit, Petroleum

##### Energy Systems

(No program in 6.3B)

##### Survivability Systems

Facility Intrusion Detection System  
Electronic Alerting System  
System Integration  
Rear Area Physical Security  
Tunnel Detection

## ENGINEERING PROGRAM

An integral part of the Belvoir R&D Center mission is the Engineering Programs consisting of Production Base Support, Product Improvement, Producibility, Engineering and Planning, Configuration Management, Program Transitioning, Technical Data Package preparation, and support of Army procurements.

The Production Base Support Program consists of seven MACI projects and three on-going Manufacturing Methods Technology (MMT) efforts. In view of FY83 Congressional Appropriation Committee (HAC/SAC) actions which reduced the proposed PA funding levels and authorized minimal necessary levels in the RDTE appropriation, the program was constrained and restructured accordingly. The funds available for Production Base Support were allocated to MACI only in the amount of \$3,815,000 and prioritized to support Center

procurement thrusts. The major PBS (MACI) efforts supported programs in Watercraft, Commercial Construction and Material-Handling Equipment, Power Generation and Air-Conditioning Components, and the Hydraulics Systems and Components areas.

The Product Improvement Program (PIP) consists of 37 TROSCOM-managed projects and 5 Belvoir R&D Center-managed programs. The Belvoir R&D Center-managed PIPs include a trailer quick-disconnect, improved fuze, and arresting-cable disconnect for the Mine-Clearing Line Charge (MICLIC), a series of system-wide improvements for the Ribbon Bridge, and an improved inflation system for the Military Amphibious Reconnaissance System (MARS). Readiness Command projects range from Army watercraft to railroad equipment and from mine detectors to bridging equipment.

During FY83, eight non-developmental or modified commercial items were transitioned to Readiness Commands as follows:

Item	Transition Date	Readiness Command
Recharge/Service Kit for Halon 1301 Fire Extinguisher	26 Nov 82	TROSCOM
Lighter, Amphibious, 30-Ton (LACV-30)	14 Feb 83	TROSCOM
Forklift Truck, 6K-lb, Rough-Terrain	28 Apr 83	TACOM
Pump Assembly, 350-gal/min, Diesel-Engine-Driven	17 Jun 83	TROSCOM
Hoseline Outfit, Fuel-Handling, 4-In. Diam	17 Jun 83	TROSCOM
Generator Set, 10-kW, 400-Hz, Diesel-Engine-Driven	24 Jun 83	TROSCOM
Small Mobile Water Chiller	30 Jun 83	TROSCOM
Tank, Fabric, Water, 3000- and 5000-Gal-Capacity	30 Jun 83	TROSCOM

The Technical Data Package (TDP) Planning effort included the preparation/updating of 98 TDPs in support of the FY83 procurement program. For the FY84 procurement program, 94 TDPs are scheduled for preparation/updating of which 24 were completed in FY83.

**First-Time-Buy Quantity Procurement.** During FY83, Belvoir R&D Center planned procurements totaling \$137.4 million. The programs are shown in the

following table. Belvoir R&D Center participates in the planning of the Army Materiel Plan (AMP) by assisting the Readiness Centers in maintaining up-to-date data for the Army's procurement planning and by attending the AMP reviews held at TROSCOM, TACOM, and ARRCOM.

Nomenclature	Standard Study Number	Quantity	(Program \$M)
Topographic Support System	MF9400	54	15.3
Position Azimuth Determining System	M757	69	23.3
Lighter, Air-Cushion-Vehicle, 30-Ton	M236	8	63.7
Container Handler, 50,000-lb, Rough-Terrain	M412	62	20.2
Reverse-Osmosis Water Purification Unit, 150,000-gal/d	M129	4	2.7
Tactical Water Distribution System	M274	2	12.2

## TECHNICAL ACHIEVEMENTS

Modern warfare as characterized by the tactics of potential adversaries of the United States consists of localized power concentration, penetration, and follow-through by insertion of a second echelon force. To counter these tactics, superior mobility of US Forces is required. Friendly force mobility and tactical flexibility must be maintained in both offensive and defensive operations. Locating and clearing minefields, crossing obstacles, breaching gaps, neutralizing area denial efforts of opposing forces, establishing survivable positions, and emplacing minefields and obstacles must be conducted far more quickly than current equipment permits. Logistic support equipment must be adequate to insure that water, fuel, ammunition, and other essential military supplies are available in sufficient quantities to sustain the fighting force. The continuing decline in the supply of petroleum-based fuels requires that military standards and specifications be evaluated and revised to insure that equipment be compatible with the fuels and lubricants that will be available in the future. An urgent requirement also exists to satisfy both the Army's increasing demands for mobile electric power and the need for more efficient energy usage. Future generators must be more lightweight, be more efficient and reliable, and have less prominent thermal and acoustic signatures. Camouflage, counter surveillance, and tactical deception equipment is essential for the survivability of US Forces.

Belvoir R&D Center is responsible for the development of materiel to meet these combat and battlefield support needs. As the materiel developer, Belvoir R&D Center has established a strong interface with the TRADOC community in order to address the practical and operational characteristics of user requirements which consists of a large number of complex and comparatively diverse fields of endeavor. As a result, Belvoir R&D Center has distributed its resources to address the areas of Combat Support and Combat Service Support and for FY83 established the four major program areas of Mobility/Counter mobility, Survivability, Energy, and Logistics.

## PROGRAM AREAS

**Mobility/Counter mobility** program area consists of counter mine, counter obstacle, wet-and-dry-gap crossing, and obstacle-breaching systems that eliminate or reduce the effects of natural and man-made barriers on friendly mobility and barrier systems that restrict the mobility of threat forces. Counter mine systems emphasize remote detection of minefields and standoff and close-in mine neutralization. Counter obstacle systems are directed at specialized counter obstacle equipment as well as commercial and airborne construction equipment. Wet-and-dry-gap crossing systems emphasize quickly emplaced tactical fixed and float bridging equipment. Barrier

systems concentrate on quickly emplaced nonexplosive barrier materials and equipment.

**Survivability** program area involves equipment and techniques which minimize threat detection and target acquisition of friendly forces, create false signatures, provide position location and terrain analysis capabilities, and deny physical access to the enemy. Emphasis is on radar and thermal IR camouflage, tactical deception, tunnel detection, intrusion detection, position locating, lighting and barriers, and artificial intelligence/robotics.

**Energy** program area is associated with energy sources and support equipment needed to live, work, move, and fight in a given environment. Energy sources produce electric power which must be distributed and conditioned to be available and compatible with user loads. Support equipment provides new energy-saving heaters and air conditioners that incorporate NBC protective and air filtering systems. High priority has been placed on development of integral CB air/heating/cooling units for shelter systems and on ground and air combat vehicles. Energy programs in the area of fuels and lubricants are directed at identification of engine oils which satisfy all requirements for hydraulic fluids, evaluation of diesel fuel stabilizer, long-life coolant systems, and alternative fuels.

**Logistics** program area provides the marine craft, water supply equipment, supply distribution equipment, fuel-handling equipment, and support equipment required to sustain the forces. Water supply systems focus on the location and distribution of water to the troops under all

combat conditions, including the integrated NBC battlefield. Emphasis was placed on the 3000-gal/h ROWPU development, operational testing of water support equipment at the National Training Center, and supplying near-term water support equipment for the Central Command, formerly the Rapid Deployment Joint Task Force. Fuels-handling systems include bulk fuel tank storage equipment and petroleum pipeline, hose-line, and pumping equipment for distribution of fuel. Priority effort in FY83 was directed toward pipelines, hose-lines, improved fuel storage tanks, and systems for operation in Arctic conditions. Marine craft systems include inland waterway and seagoing work vessels, logistic supply vessels, and over-the-shore logistic support craft. Current emphasis is placed on the LACV-30 and landing craft vessels. Support and supply distribution systems concentrate on containers, packaging, materials-handling, transportation, and distribution equipment with current emphasis on "Clean Burning" diesel engines, robotics, and automation of ammunition handling.

## SUMMARY OF TECHNICAL ACCOMPLISHMENTS

### MOBILITY/COUNTERMOBILITY SYSTEMS

#### BRIDGING

- Completed initial phase of the full-scale development contract and initiated detailed engineering design for the Light Assault Bridge.
- Awarded the advance development contract for the Heavy Assault Bridge.
- Completed installation and tested multi-cellular graphite/epoxy folded and molded sandwich panel module.
- Completed production of 45 tensile links in graphite/epoxy for field test of link reinforcement system.
- Hosted and conducted seventh meeting of the Trilateral Design and Analysis Group (DAG) and reached agreement on additional aspects of the Design and Test Code.

#### COUNTERMINE

- Completed field test which will provide the data necessary to determine the technical feasibility of detecting and locating scatterable mines during ballistic insertion.
- Evaluated new prototypes for tank track width mine-clearing plow.
- Provided foreign countermining equipment to the US Army Armor and Engineer Board for a Countermining Concept Evaluation Program.
- Completed initial fielding of the Mine-Clearing Roller in both USAREUR and Korea.
- Developed a methodology to define systems effectiveness goals for developing countermining equipment.

## CONSTRUCTION EQUIPMENT

- Developed a new dispersed mobility model to evaluate countermine systems in deep attack scenarios.
- Completed countermine information data base.
- Completed first of 2-year effort to complete development of the Surface-Launched Unit, Fuel-Air Explosive (SLUFAE) in response to issues identified at the DEVA-IPR.
- Provided support of surrogate Small Emplacement Excavators for the High-Technology Test Bed (HTTB) at Fort Lewis, Washington.
- Provided support to the priority replacement of Airborne/Airmobile Construction Equipment.
- Provided engineering support to the development of a dozer blade attachment for the airborne tank. Procured dozer blade for Armor Board testing.
- Conducted evaluation/surveys of several types of NDI construction equipment to support future NDI procurements.
- Provided engineering support to TACOM for multiyear standardization procurement of CCE Loaders, 14-Yd<sup>3</sup> Scrapers, and Heavy Road Graders.
- Conducted testing program to determine performance criteria for Small Emplacement Excavator (SEE).

## BARRIERS

- Completed study of Advanced Barrier Concepts to coincide with the objectives promulgated in the Airland Battle 2000.
- Conducted field testing for an International Materiel Evaluation (IME) project on expedient shelters to support user requirements.
- Continued to provide technical support on protective covers for evaluation by the Army Development and Employment Agency (ADEA) at Fort Lewis, Washington.
- Conducted live firing evaluation of several tactical shelter items and revetment concepts.
- Conducted logistics study in support of user requirements for protective covers (Parapet Foxhole Cover).

## **SURVIVABILITY SYSTEMS**

### **COUNTER-SURVEILLANCE AND TACTICAL DECEPTION**

- Completed laboratory evaluation of several different foreign and domestic RADAR absorbing paints/materials.
- Completed full-scale measurements on three different multi-signature suppression concepts, on turntable, at Aberdeen Proving Ground, Maryland.
- Completed preliminary field measurements (including doppler and thermal), for multi-signature suppression, on M-60 tanks, at Fort Devens, Massachusetts.
- Proposed preliminary design for multi-spectral signature suppression systems for Diesel-Engine-Driven Generator Sets.
- Refined and coordinated DARCOM plan for tactical deception, and initiated Quick-Reaction Program (QRP) for hardware development for the 9th Infantry Division.
- Completed Phase II of camouflage cover and deception study for NATO experts panel.
- Implemented DARCOM plan for adoption of the 3-color US/GE Standardized Camouflage Pattern.
- Continued further system consulting and hardware development support efforts to Ground-Launched Cruise Missile, Firefinder, Saudi Arabia National Guard, and Defense Nuclear Agency.
- Provided continuing engineering support to TSARCOM on new competitive procurement program for the standard lightweight camouflage screening system.

### **PHYSICAL SECURITY**

- Initiated Multi-Service Operational Test II on the Interim FIDS components at Eglin Air Force Base, Florida.
- Initiated Development Test II on the Interim FIDS Components at the Electronics Proving Grounds, Fort Huachuca, Arizona.
- Initiated development of the FIDS Low-Profile Console, Redundant Console, and Exterior Control Unit for Air Force use.
- Completed Development Test I on the RF Motion Sensor.
- Initiated a Producibility, Engineering, and Planning effort on the Interim FIDS components.
- Continued a detailed technical review of the Interim FIDS microprocessor software, engineering drawings, and test procedures.
- Performed DT environmental test on the latest FIDS sensors in accordance with TECOM requirements.

- Fabricated prototype of the Electronic Alerting System (EAS). The EAS provides a covert duress alerting system which allows simultaneous voice and data transmission over a single dedicated phone line.
- Developed Sound Deterrent Subsystem (SDS) as part of the Weapons Access Delay System (WADS). The SDS is designed to disrupt conversation between intruders inside a protected structure.
- Continued joint American-Canadian sensor development program for the Ported-coax Interior Sensor (PINTS).
- Adapted the Strain Sensitive Switch for use on storage pallets to detect pilferage.
- Completed prototype fiber optic sensor data link and fiber optic line supervisor.
- Prepared competitive contract to develop a flexible fiber optic data network for physical security data communications.
- Proceeded into Engineering Development with the Covert Duress Sensor (CDS) and Tagged Material Detector (TMD) sensors.
- Completed development of data acquisition system (DAC) for use in the field and the data analysis system (DAN) for in-house use.
- Installed security systems at chemical weapon storage sites.
- Developed in cooperation with the Naval Research Lab, two fiber optic sensors: floor mat pressure sensor and a fiber optic upgrade of the Passive Ultrasonic Sensor.
- Initiated development of a Portable Tagged Material Detector (PTMD) for the Customs Service. This apparatus will be used to interdict illegal export of high-technology equipment.
- Performed on-site evaluation of cargo security sensor for Military Traffic Management Command (MTMC).
- Evaluated commercial sensors and systems to supplement J-SHDS for DOD applications.
- Continued support of OCONUS technical and field support program to detect and locate suspected tunnels.
- Continued testing and evaluation of selected tunnel detection equipment at selected CONUS test sites to establish capabilities/limitations.
- Continued development of new seismic listening system with direction-finding capability.
- Continued development of new Tunnel Detection System (TUDS) for use in worldwide environment.
- Continued both advanced ADP and geophysical/theoretical studies.

## TUNNEL DETECTION



#### **TOPOGRAPHIC EQUIPMENT**

- Awarded contract for 56 additional modules of Topographic Support System (TSS) at a cost of \$15,300,000.
- Negotiated and awarded new multi-year (FY83-84) contract for 222 units of Position Azimuth Determining System (PADS) at a cost of \$67,300,000.

#### **SENSORS/ ROBOTICS/ ARTIFICIAL INTELLIGENCE**

- Initiated extensive analysis of seismic and acoustic data for acquisition and identification of site-adaptive features for the tactical target classifiers; i.e., REMBASS seismic/acoustic classifiers.
- Initiated the robotics/artificial intelligence program in battlefield terrain technology, autonomous imagery interpretation, and sensor systems for noting guidance and self regulation.

### **ENERGY SYSTEMS**

#### **ELECTRIC POWER**

- Awarded non-development item (NDI) production contract for 10-kW, 28-V Turbine-Engine-Driven Generator Set for aircraft ground support.
- Completed in-house evaluation of a 5-kW Kinematic Stirling Engine Generator Set, and initiated a follow-on program to procure militarized versions of the set.
- Initiated development of a new family of signature-suppressed, diesel-engine-driven, 15-, 30-, and 60-kW generator sets.
- Demonstrated a 1.5-kW Fuel Cell Power Unit at a special In-Process Review (IPR) in November 1982.
- Assembled two 1.5-kW Fuel Cell Power Units for abbreviated Prototype Qualification Testing.
- Entered the 3-kW Prototype Phase for the 3-kW and 5-kW Fuel Cell Power Unit Project. Demonstrated transient load capability.
- Initiated neat methanol fuel feasibility effort for 3-kW and 5-kW fuel cells.
- Initiated First Article Test phase for the 750-kW diesel-engine-driven generator set. Completed electrical performance, rough handling, and environmental tests. Initiated 500-hour endurance test.
- Initiated a program to improve design and reliability of the generator and turbine control units used in the 60-kW turbine generator set, which is a prime power source for Patriot and the Ground-Launched Cruise Missile.
- Delivered man-portable photovoltaic battery charger to Marine Corps.
- Designed, tested, and delivered a 3-kW power control and distribution center to the Facilities Engineering Support Agency.

## **FUEL AND LUBRICANTS**

- Convening of DOD Study Group on CH-47 Transmission Systems which was organized by Belvoir R&D Center to assist TROSCOM and AVSCOM in determining the cause for aircraft crashes in Germany. Ten study actions were generated from this meeting which have since been incorporated into the depot and manufacturing processes.
- Development referee fuel requirements for ensuring a full multifuel capability for advanced-designed engine system.
- Development of a field guide for improving fuel operability at low ambient temperatures.
- Developed the new Army Mobility Fuels Research and Development Plan which now incorporates the technology base programs of TACOM and AVSCOM.
- Developed and issued new military specification for diesel fuel additive stabilizer, MIL-S-53021.
- Developed and issued new military specification for multigrade tactical engine oils, MIL-L-2104D.
- Developed and issued new military specification for a vastly improved military all-purpose grease, MIL-G-10924D.

## **HEATERS AND AIR CONDITIONERS**

- Designed and fabricated 18,000-Btuh cooling capacity Scroll Compressor/expander.
- Designed an 18,000-Btuh cooling 200 ft<sup>3</sup>/min NBC filtered air Integrated Chemical Filter and Environmental Control Equipment.
- Completed heat transfer testing of new engine exhaust gas heat exchanger using special catalyst to remove unburned hydrocarbons and soot.
- Completed environmental testing on two commercial heat pump models and performed railroad transportation (hump) testing at Aberdeen Proving Ground, Maryland.
- Supported Signals Warfare Laboratory in the development and testing of a hydraulically driven air conditioner and power generator.
- Completed Integration Engineering Handbook for Environmental Control.
- Completed tests required to prove effectiveness of microclimate cooling in preventing crew member heat stress.
- Initiated procurement and testing of commercial components to determine their suitability for use in Microclimate Cooling Systems.
- Developed a refrigeration system for use in connection with portable freeze packs for both on-and-off vehicle cooling of the M3 Cavalry Fighting Vehicle crew members.

## LOGISTICS SYSTEMS

### WATER SUPPLY

- Awarded a contract to determine a water simulant for nerve-type chemical warfare (CW) agents.
- Evaluated field water storage tanks used by the US, UK, French, and Norwegian Armies; and prepared an IPR package for type classification in FY84.
- Provided two 600-gal/h Reverse Osmosis Water Purification Units to the Sinai for the Multinational Force and Observers.
- Accepted final delivery of production contract for Water Quality Analysis sets.
- Provided Water Supply Equipment for CENTCOM to the National Training Center, Fort Irwin, California, where initial operational testing and training was completed successfully.
- Accepted final tactical water distribution sets (TWDS) under the first production contract for 14 TWDS.
- Completed First Article Test on second production contract for 21 TWDS.
- Completed First Article Test on first production contract for Small Mobile Water Chillers (SMWCs).
- Provided two 150,000-gal/d Reverse Osmosis Water Purification Units to drought-stricken Kwajalein Island to produce drinking water from seawater.
- Supported US Marine Corps on Lebanon mission for water treatment.
- Supported Exercise Bright Star 83 in water mission.
- Supported US Air Force in Ascension Island with water mission.
- Completed Follow-on Evaluation (FOE) on 150,000-gal/d ROWPU incorporating hardware design changes.

### FUELS HANDLING

- Conducted engineering development testing of 200-gal/min Gas Turbine-Engine-Driven Refueling Pump Unit and 3000-gal Collapsible Fuel Tank at Cold Regions Test Center, for the Arctic Fuel Dispensing Equipment System.
- Completed developmental testing of prototype 5,000-bbl collapsible fuel storage tanks for Bulk Fuel Tank Assembly at US Army Tropic Test Center, Panama.
- Completed Developmental Testing I (DTI) and Operational Testing I (OTI) of prototype Petroleum Hose/line System.
- Completed User and Developmental Testing of prototype Pipeline Outfit, Petroleum.
- Completed Draft Technical Manuals and Training Package on the Pipeline Outfit, Petroleum.

**SUPPLY  
DISTRIBUTION**

- Conducted Engineering Development Test of Quick-Connect Pipe Coupling.
- Completed fabrication and Engineering Development Test on the critical components to the Joining Box on the Automated Pipeline Construction Equipment System.
- Completed the design and initiated fabrication of the Bulk Pipe Hopper components on the Automated Pipeline Construction Equipment.
- Fabricated two prototype Seamless Weave Collapsible Fuel Tanks and initiated testing of tanks at Yuma Proving Ground.
- Completed First Article Test for Tanker Mooring System boat launcher.
- Transitioned 350-gal/min Diesel-Engine-Driven Pump to TROSCOM.
- Transitioned four-inch hoseline outfit to TROSCOM.
- Completed specification for FY84 procurement of SSN: M484 Truck, Forklift, vs Clean Burning Diesel-Engine-powered.
- Initiated Product Improvement Program to provide Horizontal Motion Compensator for 250-Ton Container Crane.
- Completed Technology Assessment of Commercial Materials-Handling Equipment for Off-Shore Operations.
- Approved design approach for Prestaged Ammunition Loading System (PALS) Dock Facility.
- Awarded contract for Multi-Detailed Engineering, Level I Drawing Package for PALS Dock Facility.
- Developed prototype Lightweight Expandable Spreader Bar.
- Completed engineering evaluation of 6k-lb Rough-Terrain Forklift Truck.
- Completed Five-Year, First Time Buy of 50-k-lb Rough-Terrain Container Handler.
- Completed Pilot Modernization Program for 80-ton locomotive.

**SUPPORT  
EQUIPMENT**

- Awarded contract for climate-controlled End-Door Boxcar for Trident II Rocket Motors.
- Supported Defense Logistics Agency with Technical Data Package for 16-ton locomotives.
- Type classified Multi-purpose Fire Truck.
- Transitioned Halon Recharger to TROSCOM.

## **MARINE CRAFT**

- Completed First-Time-Buy efforts and engineering support on the Lighter, Air-Cushion Vehicle, 30-ton (LACV-30).
- Conducted Follow-on Evaluation (FOE) for LACV-30.
- Transitioned program management of LACV-30 contract to TROSCOM.
- Completed and distributed final market surveys and reports on the Non-Development Item (NDI) watercraft.
- Provided engineering support for the quantity procurement of modernization kits for product improvement of Marine Craft.
- Provided technical support to TROSCOM and user organizations during the installation of modernization kits and updating technical data packages of marine craft.
- Completed DTH/OTH testing of the Military Amphibious Reconnaissance System (MARS).
- Conducted Concept/Feasibility studies on the Lighter, Amphibious-Heavylift.
- Type classified the Landing Craft, Utility (LCU) and Logistics Support Vessel (LSV).

## **TECHNICAL SUPPORT**

## **MATERIAL TECHNOLOGY**

- Provided expertise for the development of a corrosion preventive coating to extend service life of military padlocks.
- Developed and issued MIL-P-53022, Lead and Chromate-free anticorrosive primer.
- Developed and issued improved version of MIL-C-46168 chemical-resistant coating for Army-wide use.
- Developed high solids polyester for use as a low-bake ammunition coating in areas with stringent air pollution regulations.
- Developed a moisture-cure one-component polyurethane coating as a chemical agent resistant coating in areas with stringent air pollution regulations.
- Developed a water reducible two-part epoxy anti-corrosive primer as an air pollution compliance alternative to present solvent-based epoxy primers.
- Developed an air pollution compliance version of the chemical agent resistant coating using the exempt solvent, trichloroethane.
- Developed packaging requirements for inclusion in 145 commodity specifications for use during pending procurements.
- Provided radioactive instrumentation training to DARCOM personnel.
- Prepared a Handbook for Radiation Protection Officers to be used throughout DARCOM.

- Evaluated radioactive content of chemicals used in restoring magnesiumthorium alloys.
- Conducted rubber processing studies and prepared technical reports on Effect of Compounding and Mixing Variables on the Physical Properties of Elastomeric Tank Pad Formulations.
- Developed improved elastomeric formulations for tank track pad applications.
- Evaluated antioxidant systems for enhancing the heat and flex cracking resistance of natural rubber compounds.

## SCIENCE AND TECHNOLOGY BASE PROGRAM

The FY83 Belvoir R&D Center Science and Technology Base Program consists of the 6.1 (Basic and Applied Research), 6.2 (Exploratory Development), and 6.3A (Non-Systems Advanced Development) Program Elements distributed by funding categories as follows:

Funding Category	FY83 (thousands)	Percent of Totals	
		Tech Base	RDTE Program
6.1	1966	8.4	4.4
6.2	12566	53.7	28.0
6.3A	8877	37.9	19.8
Total	23409	100%	52.2

\*Total RDT&E Program (6.1 - 6.4) = 44,838

Effort in the Research Program is conducted via the Single Project Funding (SPF) concept and in Exploratory Development via Single Program Element funding (SPEF) to provide the Center maximum flexibility in allocating resources. The advanced development consists of specific projects in each technical area. The magnitude of the Belvoir R&D Center Technology Base Program by Program Area is as follows:

### FY83 RDTE FUNDS BY FUNDING CATEGORY AND PROGRAM AREAS TECHNOLOGY BASE

PROGRAM AREA	(thousands)			Tech Base Total	% of Total
	6.1	6.2	6.3A		
Mobility/Countermobility Systems	373	2637	7773	10783	46.1
Energy Systems	518	1761	0	2279	9.7
Survivability Systems	510	3469	0	3979	17.0
Logistics Systems	0	1956	0	1956	8.4
Material, Fuels, and Lubricants	565	2743	1104	4412	18.8
TOTAL	1966	12566	8877	23409	100.0

## **MOBILITY**

- Completed the design of the Counterobstacle Vehicle (COV) test bed.
- Completed Firefinder Modification analysis.
- Initiated data collection for air/liquid interface for explosive detection using enzymes.
- Evaluated effects of explosive configuration on line charge performance.
- Completed test runs of Mine Information Data Base.
- Initiated contract on the High-Resolution Sensor.

## **ENERGY**

- Developed integrated control systems for variable area turbochargers.
- Identified limitations of adiabatic reformation.
- Defined electrode structures for freeze tolerance.
- Completed the bread-board design of the 18,000-Btuh Integrated Chemical Filter and Environmental Control Equipment (ICE).
- Initiated ICE compressor/expander testing.

## **LOGISTIC**

- Completed design of all high-risk components for APCE.
- Completed tests on pipe joining process and pipe joint hardware for the Automated Pipeline Construction Equipment (APCE).
- Established design parameters for Improved Refueling system.

## **SURVIVABILITY**

- Completed evaluation of computer-controlled backhoe as high-capacity arm.
- Completed investigation of robotic locating subsystem for Mechanical Handling Equipment.
- Completed CONUS/OCONUS field evaluation of selected seismic DF computers.
- Initiated development of advanced data processing algorithms.
- Completed evaluation of seismic detection recorder system.

## TECHNOLOGY TRANSFER

The current manpower situation and persistent demands on our technical staff, have resulted in a notable decline of activities in the Technology Transfer area. To counter this trend, especially in view of Public Law 96-480 and Army Regulation 70-57, "Military-Civilian Technology Transfer," management has initiated preliminary steps toward a Technical Volunteer Program. This program, as successfully demonstrated by other Government agencies, envisions the enlistment of retired former employees to promote the transfer of Belvoir R&D Center know-how to surrounding communities. Implementation of a modest program of this nature is planned for FY84. The following paragraphs describe a few outstanding RDT&E activities which resulted in direct benefits to the civilian sector.

**Volatile Organic Compound (VOC) Emissions and Toxic Substances Exposure.** The Materials, Fuels, and Lubricants Laboratory is working with the Environmental Protection Agency (EPA), National Institute Occupational Safety and Health (NIOSH), Occupational Safety and Health Administration (OSHA), and the industrial paint and raw material suppliers on conformance to Federal Regulations on Volatile Organic Solvent emissions. This includes toxic waste and work place safety regarding toxic exposure to lead, chromates, and other heavy metals. Many new technologies have been developed in the area of low solvent content coatings for organic solvent emissions compliance. These technologies are not only being used by the Army, but also by Army industrial contractors and non-government users. A significant amount of work has been done in replacing lead and chromates in anticorrosive primers and performance results have been superior. The information on these coatings using an organic zinc complex pigment has been transferred to industry for their use. All Army camouflage coatings are being converted to a lead-and-chromate-free pigment without the use of toxic substances. These pigments are commercially available and can be purchased and used by private industry.

**Hydraulic System Test and Repair Unit (HSTRU).** The Engineer Support Laboratory has developed a Hydraulic System Test and Repair Unit (HSTRU) that

has been fielded and is currently in a re-buy status. The Tool Outfit, Hydraulic Test and Repair, Mobile is a trailer-mounted unit that is used to provide for the diagnosis of hydraulic systems failures and to repair and assemble hydraulic lines and hoses. It is a contact maintenance type unit designed to be towed between job sites by other vehicles. The HSTRU is made from a government-furnished trailer and commercially obtainable components. The diagnosis and repair of hydraulic systems failures at the job site saves time, results in higher job performance, and is expected to be widely used by commercial contractors for the maintenance of hydraulic equipment. The increasing complexity and density of hydraulic components on modern equipment, such as construction equipment, will require an increased ability to service and maintain these components.

**Technology Transfer in Emergency Situations.** Over the years, Belvoir R&D Center has enjoyed a reputation for quick response regarding emergency situations. Recently, our Logistics Support Laboratory responded to a request from the Army Ballistic Missile Defense System Command. Two reverse osmosis water purification units, each capable of producing 150,000 gal/d drinking water from sea water, are being used to purify sea water for soldiers on Kwajalein Island during a serious drought. The Island of Kwajalein is home to about 3,000 military and civil service personnel, contractor employees, and their families. They operate Kwajalein Missile Range for the Army's Ballistic Missile Defense System Command. The Reverse Osmosis unit purifies water by forcing it under pressure through a special spiral-wound membrane to remove salt, dissolved solids, microorganisms, and other contaminants. This process used to require four different treatment operations. The two Reverse Osmosis units were built by Cosmodyne, Inc. and they are supporting the operation. The units were originally procured by Belvoir R&D Center for the Army's new Central Command, formally the Rapid Deployment Force. They were pulled out of storage for this emergency and will be returned to depot stock when they are no longer needed.



## IN-HOUSE LABORATORY INDEPENDENT RESEARCH (ILIR)

The objectives of the ILIR program are to improve the quality of Army laboratories, to fund new thrusts and seed projects, to attract and retain top scientists and engineers, and to provide the Technical Director flexibility for technical entrepreneurship. Scientists and engineers compete for ILIR funding with proposals which are judged on relevance to laboratory mission, innovativeness, degree of risk/pay-off, and enhancement of capability. The funds for the ILIR program are allocated directly from the Assistant Secretary of the Army (RDA) to the Technical Director on the basis of the previous year's performance. In FY83, Belvoir R&D Center received increased funding for the ILIR program in FY83 based on favorable review of the FY82 program by the Department of the Army and the Board on Army Science and Technology of the National Research Council.

Belvoir R&D Center's FY83 ILIR program consisted of 15 projects with a total funding of \$540,000. Of this group, five were projects which continued from FY82. We had several successful and innovative projects which have significantly contributed to the mission and to the capability of the laboratory. An investigation of a

"Modular Power Switch Using Field Effect Transistors" explored the use of multiple FET's in parallel configuration. This had led to a fully functional switch which we transitioned to the advanced development program in power conditioning. Work on "Fiber Optic Links" has allowed rapid assimilation of new technology and is already being applied to a high-voltage pulser for the generation of high peak power. A novel concept for fire-resistant fuels is being investigated in the project. "Mitigation of Fuel Fires via Micellar Systems." This investigation offers a promising alternative to the method under current development which has not met all user expectations in view of the requirement for mixing with clean water in the forward area. Projects dealing with "Expert Systems," "Scene Analysis," and "Decision Support Systems" represent a deliberate effort to bolster Belvoir R&D Center's posture in the rapidly advancing area of computer intelligence. This group of projects is dramatically improving Belvoir R&D Center's capability of dealing with new technological challenges in this area. The overall ILIR program reflects the diversity of Belvoir R&D Center's technical programs and has a substantial impact in terms of benefits accruing to the individual investigators and the Center.

## ACTIVITY INDICATORS

During FY83, Belvoir R&D Center originated a total of 275 formal reports, technical articles, and presentations. Out of the total number of 175 reports and technical articles published, 56 were prepared by Belvoir R&D Center personnel and 119 were published by contractors. Three patent applications were filed and two patents were issued during this year. Two Belvoir R&D Center personnel received the prestigious Department of Army R&D Achievement Award. A summary of Belvoir R&D Center's activity indicators is presented in the following table:

### FY83 ACTIVITY INDICATORS

In-House Formal Reports Published	23
Formal Reports Published by Contractors	106
Technical Articles Published	33
Formal Reports Published by Dedicated Contractors	13
Technical Presentations	100
Patents Issued	2
Patent Applications Filed	3
Patent Applications Pending From Previous FYs	11
<b>AWARDS</b>	
DA R&D Achievement Award	2
Special Act or Service Award	127

## AWARDS

The Incentive Awards and Annual Commander's Award Program continue to improve and grow. These programs are the means by which the Center recognizes significant individual achievements and contributions in the areas of technological and scientific advances, cost reduction, energy conservation, value engineering, management, equal opportunity, leadership, and outstanding job performance in support of Center goals and objectives.

The Army Research and Development (R&D) Achievement Award was approved for Messrs Carl F. Heise and Michael A. Mando of the Engineer Service Support Laboratory. The team developed a basis for the design and evaluation of insulation systems in the short duty cycle, high power density electrical machinery required for the Army's beam weapons program. The work established the feasibility of an insulation system to withstand the severe requirements of this application, the probable relationship between laboratory type measurements of such an insulation system and its actual performance in high power density generators, and the importance of voids and small air bubbles to the life of the system. The work will also increase scientific knowledge related to pulse power generators and accelerate development of electrical machinery for advanced laser systems and will be of great benefit to the Army's laser program.

The highest Merit Pay Significant Accomplishment Cash Award to date at Belvoir R&D Center received by John Dixon, Chief of Safety, Health, and Environmental Office. Mr. Dixon exhibited high motivation, sound judgment, and superior technical expertise resulting in tremendous improvements to the Belvoir R&D Center Safety Office. Of particular significance were his involvement in system development, his accelerated promotional efforts, and his handling of the newly assigned function of environmental coordinator. In addition, the Center's accident rate is the lowest it has been in over 6 years.

The Belvoir R&D Center Annual Commander's Awards is a local program established by the Center to complement the Army R&D Achievement Awards Program by recognizing outstanding contributions in scientific, technical, administrative, and leadership achievement. This year marks the 26th Anniversary of the awards.



Winners of the 1983 Commander's Awards joined the presenters on stage for this photo. (Left to Right) Robert E. Clark, Maj. Gen. Kenneth E. Lewi, Mrs. Goldie E. Gutmann, Robert M. McKechnie, Mrs. Lavon S. Joyce, Col. Theodore Vander Els, Roger M. Atkins, Mrs. Walter C. Gelini, and Richard W. Helmke.

The Commander's Award for Scientific Achievement was awarded to Mrs. Lavon S. Joyce for her individual accomplishments in research and exploratory development in electrochemical energy conversion. Two Commander's awards were presented for Technological Achievement: Mr. Roger Atkins for his engineering insight and ingenuity in developing a new signature algorithm that will maintain the effectiveness of the Vehicle Magnetic Signature Duplicator; and Mr. Richard W. Helmke for his contributions in successfully applying space age composite materials to military bridging. The Commander's Leadership Award was received by Mr. Robert M. McKechnie for his leadership achievements as development project officer for the electrical power and environmental control subsystems of the PATRIOT missile system. Two Gelini Medals, which were named in honor of Colonel Walter C. Gelini, former Commander, were presented this year for technical and administrative support. The Gelini medal for Technical Support was awarded to Mr. Robert E. Clark for his technical knowledge and leadership needed for successful fabrication of the first production EPP II models for the PATRIOT missile system. The Gelini Medal for Administrative Support was awarded to Mrs. Goldie Gutmann for her diligent efforts which led this Center's successful transitioning of nine programs.

In addition to the major Center Awards, the following categories of Incentive Awards were presented during FY83:

Quality Salary Increases (QI) — 20  
Sustained Superior Performance Awards (SSPA) — 82  
Special Act or Service Awards (SA/SA) — 127  
Honorary/Awards — 2

Merit Pay Awards presented to date in FY83 are as follows:

On-The-Spot Cash Awards — 2  
Merit Pay Significant Accomplishment Cash Awards (SACA) — 7  
Special Act or Service Awards (SA/SA) — 13

## FACILITIES/CAPABILITIES

The Belvoir R&D Center has unique facilities and special instrumentation to perform the research, development, and testing in the assigned mission areas of the Center.

### FUELS AND LUBRICANTS

Two separate laboratory facilities support the Fuels and Lubricants program. One is located at the Belvoir R&D Center; the other is located at Southwest Research Institute in San Antonio, Texas. The laboratory at Belvoir R&D Center is equipped to conduct tests such as those contained in the Federal Test Method Standard for Lubricants, Liquid Fuels, and Related Products and The American Society for Testing and Materials (ASTM) Standards. The laboratory at Southwest Research Institute is a government-owned, contractor-operated facility equipped to conduct research and development programs on fuels and lubricants which range from laboratory chemical characterization of materials to full-scale engine tests to determine fuel, lubricant, and engine performance and compatibility.

### FUELS HANDLING

A test facility is available for test and evaluation of fuel filtration equipment. The facility is equipped with the necessary calibration test equipment to conduct specification quality assurance tests of standard DOD fuel filter/coalescer elements and equipment to qualify supplier-manufactured items. Additionally, test equipment to clean bilge water for discharge meeting US Environmental Protection Agency (EPA) requirements exists to test elements used to remove trace amounts of oil from separator elements used on Army watercraft.

### WATER RESOURCES

Research, development, and testing activities related to the Military aspects of water resources and equipment are conducted in an office/shop laboratory building located on the Belvoir R&D Center grounds. The building contains bays for housing full-scale, field-type water purification equipment. Support chemical and bacteriological laboratories are available, equipped with a full range of analytical instrumentation to support these programs. An exterior test pad is also available with accompanying storage tanks and other auxiliary equipment.

### ELECTRICAL POWER

A multi-megawatt flywheel facility permits testing of high-speed, high-power, low-duty alternators and gear box assemblies. This facility, coupled with a flywheel burst containment area and conventional dynamometer stations, provides a full range of capability for developing and evaluating pulse-power supplies and components for foreseeable directed energy systems.

The surface research facility at Belvoir R&D Center allows scientists to study the surface properties of solids and to investigate phenomena such as catalysis and corrosion in energy motivated and related projects. The techniques of Auger Electron Spectroscopy (AES), Electron Spectroscopy for Chemical Analysis (ESCA), and Mass Spectroscopy are combined with a multiple

analytical computer system to conduct investigations of geometric and electronic surface properties of catalysts and to study the kinetics and mechanisms of chemical reactions. Systems automation permits programming certain aspects of instrument operation, data collection, and a wide range of data processing routines.

A research capability has been developed to evaluate advanced fuel conditioning catalysts. This system includes a miniaturized fuel reactor to evaluate the efficiency of catalysts for the conversion of methanol or logistic fuels to a hydrogen-rich feed stock for fuel cells. The fuel reactor is equipped with temperature monitors and sampling ports connected to microprocessor-controlled analytical equipment which are used to characterize the reactions occurring on the catalyst materials.

### **MATERIALS RESEARCH AND TESTING**

The Material Technology Laboratory conducts a broad program of research, development, engineering test and evaluation, prototype fabrication, and specification reviews in the field of organics, metals, plastics, ceramics, coatings, rubber, radiation, adhesives, coated fabrics, paper chemistry, preservatives, fuels, optical and spectral properties, as well as packaging and transportability. Facilities which make these efforts possible include:

- Radioactive Materials Analysis.
- Optical and Luminosity Measurements.
- Physical and Mechanical Metallurgy.
- Nondestructive Test.
- Plastics and Ceramics.
- Rubber and Coated Fabrics.
- Electrochemistry and Corrosion.
- POL Analysis.
- Paper Technology.
- Classical and Instrumental Chemical Analysis.
- Organic and Chemical Coating.
- Packaging Development and Engineering.

### **BRIDGING**

Facilities include a variety of test sites, test equipment and sophisticated strain-gage instrumentation. These facilities are needed to determine the structural integrity and load-carrying capabilities of newly developed prototypes, existing and modified bridges and bridging systems, armored-vehicle launchers, bridge-erection boats, and landing craft and ancillary equipment. Signals from strain-activated sensors such as strain gages, load cells, torque and pressure transducers, and accelerometers are recorded on dynamic or static strain data acquisition systems and are converted to practical engineering data.

### **WATER CRAFT**

Within close proximity of the main shipping channel of the Potomac River, Belvoir R&D Center has a naturally protected basin which is primarily used for testing and demonstration of small craft. The water in this basin is deep enough (12 ft) to accommodate boats such as the LCU, LCM-8, Ribbon Bridge Erection Boat, Small Tug, and Harbor Service Boat. Also available is a concrete ramp for trailer-launched boats, limited fueling capabilities, potable water replenishment, docking facilities, and a dock-mounted hoist (5-ton capacity).

### **COUNTERMINE**

The minefield test lane facility provides controlled environmental conditions for the test and evaluation of experimental and product-improved mine detectors against various types of mines buried in soils collected throughout the world. A road 1300 feet long and two 8-foot x 2200-foot lanes are used for outdoor testing. Both facilities are instrumented. Computers analyze the detection rates against various types of mines and the cause of false alarm signals.

A shielded radio frequency anechoic chamber is used to measure the far-field and near-field radiation pattern of special-purpose antennas designed for possible use in countermining operations. The chamber, which measures 30 feet x 17 feet by 14 feet high, has an RFI attenuation greater than 80 dB and a cylindrical quiet zone 6 feet in diameter and 15 feet in length. The reflectivity in the zone is -40 dB at 100 MHz and -60 dB at 5000 MHz.

## **CAMOUFLAGE**

A camouflage evaluation facility provides an analytical capability for evaluating new camouflage concepts and assessing the vulnerability of equipment to detection by various sophisticated surveillance systems.

The facility, which is also used to investigate materials from other countries and to monitor contractor performance, is linked to the Belvoir R&D Center computer center for rapid analysis, storage, retrieval, manipulation, and storage of data. Its instrumentation permits the measuring of the electromagnetic properties of materials throughout the surveillance spectrum and particularly in the thermal infrared (2-15 microns) and X-band radar (10-GHz) regions.

Thermal measurement capabilities include directional emissivity, diffuse and specular reflectance, diffuse and specular transmittance, spectral radiance, temperature, and thermal image.

The macroscope, developed expressly for Belvoir R&D Center, facilitates "built-in" camouflage in development combat equipment and identifies retrofit camouflage treatments for fielded equipment.

Total radar cross-section measurements are made at any azimuth and elevation angles, and critical aspects are analyzed by a quantitative imaging system to identify radar "hot spots."

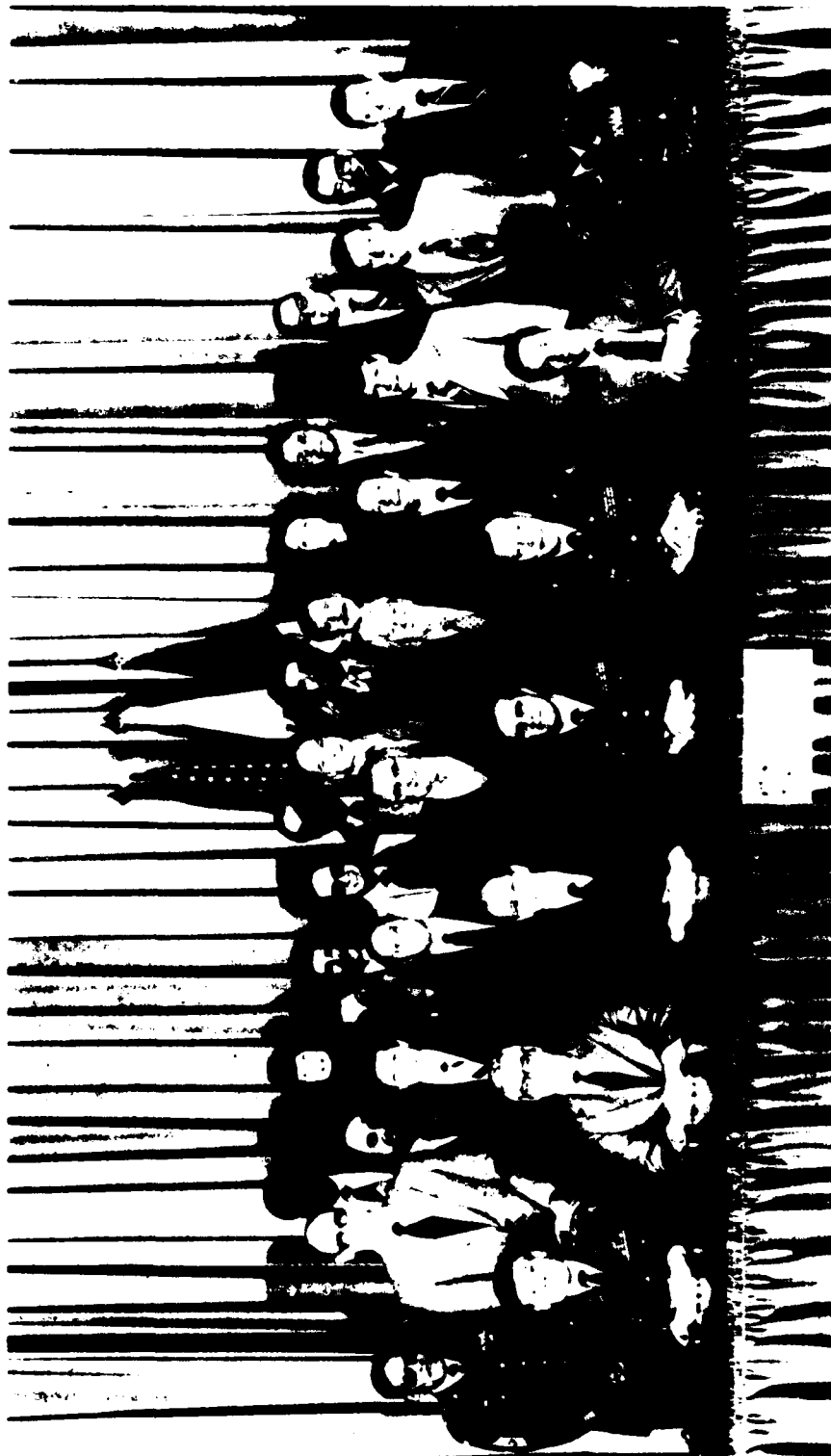
## **PRODUCT ASSURANCE AND TESTING**

The Product Assurance and Testing Directorate conducts a comprehensive program of testing, evaluation, and qualification of components, equipment, and systems in the investigative, development, pre-production, and product improvement phases. Facilities include the Belvoir R&D Center Testing Area, Electrical and Mechanical Testing, and Environmental and Field Testing.

**Belvoir R&D Center Testing Area.** The 820-acre Belvoir R&D Center Testing Area is used extensively to test heavy construction equipment, materials-handling equipment, sensors, detectors, camouflage equipment, and barrier creation and reduction techniques. Facilities include concrete and gravel test tracks for vehicle testing; a fording basin; pothole course; side slopes for vehicle grade tests; sound measurement facility; forklift truck facility; and a number of test ranges that simulate the variety of terrain features required for effective barrier and camouflage system development.

**Electrical and Mechanical Testing.** Electrical and Mechanical Testing facilities include Electromagnetic Interference (EMI) testing; Simulated Field Sound Chamber; Test Area used for endurance testing of power generating equipment, dynamometer, multipurpose test cells used to evaluate various items of equipment; exhaust emissions-measuring equipment, shock and vibration testing equipment, and a data acquisition system for multipurpose acquisition of reliability data.

**Environmental and Field Testing.** Environmental and field testing facilities include performance test chambers to conduct cooling capability, endurance testing, and durability/reliability test on air conditioners; heater test facility which provided a means of testing equipment in various climatic conditions.



1983 BELVOIR R&D CENTER COMMAND GROUP AND SENIOR STAFF

Seated 1 to R: COL R. K. Cornell, PM, PSE; P. Bolan, ATD; T. W. Lovelace, Technical Director; COL D. B. Bulger, Commander; COL A. K. Reiser, Deputy Commander; M. Zusman, PDR; LTC I. Birmingham, Executive Officer

2nd Row: SGM D. A. Parker, Sgt. Major; R. T. Sale, III, C. FSS Lab; Dr. K. J. Oscar, C. FS Lab; E. J. York, C. MF&L Lab; S. A. Kilpatrick, C. CAS Lab; K. K. Harris, Ch Engineer; J. A. Smith\*, C. Prgm Spt; K. J. Dean\*, C. Sys Anal; Dr. K. H. Steinbach, Ch Scientist; A. T. Sylvester, II, C. Prgm Plan

3rd Row: W. R. Wood, D. Res Mgt; W. H. Booth, III, D. P&P; F. D. Hardin, D. PA&T; W. L. Keyes, D. R&IS; J. F. Matcalf, Ch Counsel; M. Friedland, D. S&F; J. Hilkman, AD, CPD; MAJ N. G. Comstock, OF Ocr

4th Row: R. W. Young, FO Ofcr; S. L. Friedland, FWP Mgr; L. A. Villahermosa, Hsp Mgr; E. C. Warr\*, C. CPSO; L. Kelley\*, SADBUCS; E. M. Morrissey, PAO

Not Shown: J. A. Christians, C. US Lab; John Dixon, Jr., C. Safety; D. B. Scott, Jr., D. MIS

\* Acting

